JPRS-UAC-90-003
7 JUNE 1990

Foreign
Broadcast
Information
Service

JPRS Report

Soviet Union

AVIATION & COSMONAUTICS

No 11, November 1989

Soviet Union
AVIATION AND COSMONAUTICS
No 11, November 89

JPRS-UAC-90-003 *7 June 1990*

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[The following are translations of selected articles in the Russian-language monthly journal AVIATSIYA I KOSMONAVTIKA published in Moscow. Refer to the table of contents for a listing of any articles not translated.]

Air Force Political Chief Urges More Effective Political Worker Performance

90R10008A Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 89 (signed to press 6 Oct 89) pp 1-3

[Article, published under the heading "Anticipating the 28th CPSU Congress," by Maj Gen Avn G. Benov, member of Military Council, chief of Air Force Political Directorate: "Reviving Commissar's Honor"]

[Text] October 1917! The swiftness of events in those years, the uniqueness and exceptional importance of those events, which were expressed in liberation of the peoples of Russia, under the leadership of the party of Lenin, from the oppression of capital, shook the world. Ever since those distant years we have been the object of attention of the world community. Defending the democratic achievements of the October Revolution at an incredibly high price in struggle against domestic counterrevolution and intervention, the people united behind the main political nucleus—the Bolshevik Party. Its finest representatives—comrades in arms of Vladimir Ilich, demonstrating models of commissar honor and party conscience in their highest moral and ethical significance, were always out in front in the most difficult sectors, leading the masses. These qualities helped them gain victories in difficult, savage political and ideological struggle.

From the vantage point of the present day one can state that the phenomenon of October lies not only in those staggering events which took place 72 years ago. Tortured in prisons and executed by Stalin, crushed and discredited by the faithful servants of the system of rule by administrative fiat during the years of stagnation, the ideas of Leninist socialism, which was conceived in October 1917, began the process of vigorous revival starting in April 1985, having demonstrated their vitality and current relevance.

The October revolutionary process is continuing, gathering strength in deeds and events connected with the perestroyka which is taking place in this country. And once again, just as 72 years ago, the Communist Party was the initiator of socioeconomic and democratic reforms, acknowledging its mistakes in an honest and open manner, accepting full responsibility for distortions which have occurred in the Leninist policy of building socialism.

And once again the CPSU is fighting for implementation of the ideas and principles of the October Revolution against a background of highly complex sociopolitical processes. Extremist manifestations are intensifying, appearing in various forms and in various societal domains. All kinds of far-rightwing unofficial [neformalnyy] organizations are attempting to mount attacks on the Communist Party and by means of various falsifications are attempting to claim that the party is no longer able to function as the political vanguard of our people. More and more frequently one hears expatiations about a great crisis in the party.

Like it or not, life is such that spume always forms on the crest of any progressive revolutionary wave (and perestroyka is precisely such a wave). This is a rich nutrient environment for various demagogues, nationalists and half-baked "philosophers" and "politicians," who seek not so much to help the country emerge from its difficult situation as to earn by doubtful means no less doubtful dividends, in order to grab the banner of perestroyka and shamelessly to seek to profit on the sacred concept of "representative of the people" for their own mercenary or other interests. Since April 1985 we have seen many such "leaders for an hour," who are deathly afraid of personal responsibility for the fate of the people. In connection with this, political vigilance and maturity on the part of Communists and vigorous activity by representatives of the CPSU, which constitutes the sole genuine force capable of leading the country out of the precrisis state, is once again coming to the forefront. There is simply no alternative to the party. It is necessary soberly to grasp and clearly to see this fact through the demagogic verbal husk scattered by the "ultraradicals."

The September (1989) CPSU Central Committee Plenum showed once again that the time through which we are presently passing is a complex time indeed. The events taking place in our country are diverse, conflictive, and ambiguous. Perestroyka has stirred up everybody and everything. Under these circumstances it is important closely to monitor the current situation, in order to prevent apolitical resonance, which would threaten collapse of the socioeconomic and political "bridge of state." One can state with assurance that the CPSU is reliably keeping the initiative in its own hands, thanks to the fact that the party is restructuring itself as it goes, cleansing itself of former functions, obsolete methods and work style. From this proceed a number of important, fundamental elements for us military political workers, ideological and party activists, and party members.

It is quite understandable that the processes which are taking place in this country are not bypassing the military, which is the flesh and blood of the Soviet people. They are also manifested in Air Force units in one way or another. A great many social, economic, ethnic, and job-related problems certainly piled up in the military during the years of stagnation. These are acute problems and demand resolution at the earliest possible time. Many of them come directly or indirectly within the purview of political agencies. But here is what is a matter of concern. One frequently observes the following in Air Force units and subunits. Instead of rolling up their sleeves and going about the task of overcoming difficulties connected with increasing operational readiness and improving the working and off-duty conditions for Air Force personnel and their families, some representatives of political sections, in seeking to explain away their passiveness, state with an air of resignation that the prestige and authority of political workers is declining,

since there has been an overall decline in the image and reputation of the party as a whole. For this reason it has become very difficult to work with people.

It was necessary thoroughly to examine this problem, for it is a serious matter to consider a secondary role played by political agencies and party activists! Here is what was determined by a thorough examination of this question by the political directorate. The image and reputation of political agencies, party committees, and their representatives have indeed diminished substantially in the eyes of Air Force personnel. But this applies only to those who continue to work in the old manner, who have not gotten rid of habits of rule by administrative fiat. Political sections and party committees which place themselves above the collective, which take the position of scrutinizers and inspectors of all processes pertaining to combat training, ideological and societal affairs, who shove all others aside, who issue mandatory guidelines and commands "from above," indeed fail to be supported by the rank-and-file party members. Nor is this surprising. Times have changed. Every Air Force man with self-respect, who performs his duty honestly and uprightly, no longer wishes to perform the function of a "mere cog," but wants to be heard and understood.

Nevertheless unfortunately some political agencies and party organizations are in no hurry to restructure themselves and are in no hurry to give up an outright dictatorial work style. Why is this? The answer is obvious. It is much easier to exercise party leadership in this manner. But the problem is that this is only an illusion of leadership, since the main element in the job of party organizations is lost—their role as political vanguard of Air Force units, a genuine rather than a lip-service link with Air Force personnel.

The fact is that the old stereotypes of party political work persist, from a time when, for example, a party committee secretary had no hesitation about pounding his fist on the desk and putting a recalcitrant party member "in his place," while a political section chief, for example, "breaking" a party member who was uncompromisingly opposed to shortcomings, would hasten to attach to him a label of immaturity, or even indifference toward politics. Thus at best one can force another to say "the right thing," but it is impossible to keep a person from thinking in the manner he deems correct (even if he is profoundly in error). Thus what would occur would be a splitting of the individual, where a person would say one thing at a meeting, think another thing, and do still another thing. You cannot change a person's ideological platform by abusive shouting, pressure, or intimidation. On the contrary, what is needed is painstaking, finely-controlled, delicate and at the same time aggressive effort by party activists. The political section headed by Col V. Zimin, for example, works precisely in this manner.

Addressing a CPSU Central Committee conference on 18 July, Mikhail Sergeyevich Gorbachev stated with good reason that our duty today is to conduct political work among the masses, to advance bold ideas and to explain them to people, to act in an open manner, to prevent the growth of negative phenomena, vigorously to promote everything new and progressive, and effectively to foster the solving of problems connected with people's daily lives. This is particularly important in the present sociopolitical situation, a complex situation characterized by differing opinions, people's increased political activeness, a sharp upsurge in civic initiative, and development of independent activities by organizations and the emergence of new movements. Each party organization, proceeding from the common tasks, must have its own program of action, corresponding to the specific conditions in which it operates. Such programs of action should be open to any initiative seeking to benefit others. It is particularly important to bear this in mind in the course of preparations for the 28th CPSU Congress—a most important political event.

In connection with this there is occurring a considerable increase in the ability of party organizations and party agencies, utilizing a certain degree of independence, to organize their work taking into account those problems which are of profound concern to the unit, taking political methods of leadership as a foundation.

Unfortunately we must note that far from all party agencies are capable of working at full strength and efficiently, relying on their own initiative and political intuition. We still have many leader personnel who adhere to the following principle: they will move heaven and earth if instructions come from the higher echelon, but they will not lift a finger if there are no instructions.

I have seen time and time again that it is precisely political section chiefs, party committee secretaries, and subunit deputy commanders for political affairs who follow such a professional credo who have no time for people, since they are busy primarily with preparing briefing letters, orders, and instructions. Incidentally, they claim to be totally in favor of independence, but very often they interpret it to mean only the ability to carry out independently, conscientiously and without urging those same orders and instructions which are channeled to Air Force units in such abundance. In this atmosphere they prize most highly unthinking, blind efficiency of execution and "controllability." On the other hand they fear those who are capable of unconventional, other than run-of-the-mill decisions. They become confused when they encounter such persons.

Once again we feel the presence of that old ailment: to act on instructions "from the higher echelon" rather than making an independent decision. We are dealing here with cadres, specific individuals, who head political agencies and party organizations. Many of them went through the formative stages during the years of stagnation, when individual initiative was simply punished. Precisely in this period fear of superiors gradually pushed back into a secondary position in the consciousness of certain political workers such qualities as commissar honor and party conscience. Without reviving

these qualities there is no point in expecting party workers to be ready and willing to take responsibility upon themselves. But without such readiness and willingness there can be no manifestation of personal initiative.

As we see, this is a vicious circle. Breaking out of it is one of our paramount tasks. And this task is being accomplished. The activities of the party committees in which Lt Col V. Yakovenko and Maj V. Kutepov serve as secretaries constitute confirmation of this. These party leaders are themselves pioneers of all new and progressive developments.

I would like to voice one word of caution. There is no need to panic or go to extremes over these problems. Each political worker and party activist should thoroughly analyze anew his functions and role in the collective and draw the appropriate conclusions. One should at the very least honestly answer the following question: to what degree am I, a Communist, a fighter for embodiment of the ideas of the party to which I belong? I feel sure that a great deal depends on the sincerity of the reply.

As was noted at the CPSU Central Committee conference on 18 July of this year, we are going through a unique period of transition, which is characterized by the fact that, whether we like it or not, the old forms of political affairs and new approaches, which are gradually gaining strength, exist side by side. Both the new and the old are correspondingly interwoven in the work of party agencies. Herein lies the entire difficulty and the entire conflictive nature of the moment. But there is nothing unexpected or surprising here. Nevertheless we must already today, let alone in the future, thoroughly analyze what the role of the party should be in conditions of perestroyka. We must analyze it in order step by step to reject the old methods and adopt the new. This will not happen automatically. In addition, deep-rooted habits will constantly make their presence known. And we are already feeling this.

The key to solving many problems connected with internal party affairs lies in consistent activities on the part of primary party organizations, in consonance with the atmosphere established within society, corresponding to the acuteness of problems, people's aspirations and expectations. One should not calmly accept the fact that today, when passions are boiling all around, when different opinions are clashing, total peace and harmony prevail in many party organizations. In order to satisfy their curiosity and to express their opinion on vital issues, party members are attending various debates and political rallies. This of course is their right. What is bad is the fact that they are unable to discuss in their own party organizations all these issues which are of concern to society.

At this point I would like to say the following. Sometimes you attend a party meeting in a line unit and, listening to speeches by party members, at first you note with satisfaction: party members are showing a high degree of activeness, and the speeches are critical. By the end of the meeting, however, your impression changes. The fact is that when you begin to look more deeply into what these Air Force personnel are saying, you realize that this is not genuine criticism but rather garden-variety fault-finding captiousness. I have noted time and again with disappointment that self-castigation has become practically "the thing to do" at party meetings and conferences. But what is the point of a person bringing out all his shortcomings, and then the next day continuing to work the same as before—doing a fair to middling job?

Speaking of criticism, we always accompany it with the word "constructive." And this is very important, since the value of criticism and the effectiveness of correcting shortcomings with it is determined not by the sharpness or harshness of what is said but rather by truthfulness, effective demonstration and proof, and competence. It should be friendly, direct, contain no petty calculations, and not be falsely complimentary. Nothing other than sincere, well-argued statement of deficiencies can evoke a positive, meaningful response; fault-finding captiousness cannot accomplish this. Vladimir Ilich Lenin once warned that a "negative" slogan not linked to a specific positive solution fails to "focus" but rather deadens consciousness, since such a slogan is nothing but empty words. This point is always remembered, for example, in the political section headed by V. Kovshov. It is gratifying that political section personnel skillfully utilize meaningful criticism in their preventive efforts.

There is also another aspect to this problem. It has been ascertained from conversations with party-member Air Force personnel that recently some of them simply prefer not to voice criticisms. Why is this? It is because nobody responds to criticism, no measures are taken in response to critical comments and suggestions, and because persons voicing criticism can expect nothing but trouble from truth stated face to face with their superiors. This would seem to be because the mechanism of registering critical comments from the lower echelon is not working in some places. The minutes of party meetings, statements and requests by Air Force personnel are not analyzed by political agencies and party committees, and measures are not taken in response to presented suggestions. In other words, the management mechanism is not in gear. After speaking up a couple of times and seeing that it is a waste of time, a person simply accepts the deficiencies. Subsequently a political section chief, failing to hear the "voice of the people," becomes dejected: it is difficult, very difficult to combat passivity in people! I am still talking here about commissar honor and party conscience.

One of the principal tasks of party agencies is to ensure that the mechanism of registration of critical comments and suggestions by Air Force personnel at meetings, in letters, etc functions continuously and at all levels and to ensure that appropriate response is given to every single instance of squelching or suppression of meaningful criticism. Political workers should constantly seek to

ensure that the sword which heals wounds is always reliable and effective in practical application. Examples of this include the 27th CPSU Congress, the 19th CPSU Conference, and CPSU Central Committee plenums.

One more comment. Man is the object of influence for us political workers. Means of influence include the spoken word and personal example. That squadron or regimental deputy commander for political affairs who flies, shoots, and bombs worse than his subordinates has very little value. It does not matter what he says or how passionate his appeals to the men—his speeches will remain mere lip-service declarations. This is a feature of the job—the commissar is not entitled to weaknesses.

On the other hand, ideological and political influence on others is inconceivable without feedback—constant concern for the men and their families. A great many political workers who have parted company with their position have been done in by hardness of heart and the inability to feel the pain experienced by their subordinate or to see the latter's despair in a prompt and timely manner. In this regard I can state quite unequivocally that the political directorate will continue in the future to take resolute adverse action against those political workers who have become separated from personnel, who constitute "dry" party functionaries. If Air Force personnel give a wide berth to the office of the regimental deputy commander for political affairs, the party committee secretary, and the Komsomol committee, such political workers have nothing to contribute to the men of that base. I can assure you that they will be replaced in short order.

We have no other recourse in this difficult time. Practical experience indicates that half-measures and lack of mutual demandingness merely aggravate social ailments. In addition, one must bear in mind at all times that, as one public affairs writer put it, when the revolution is advancing swiftly upward and its success is inevitable, particular vigilance is required to ensure the purity of its principles and its banner, since at such a moment genuine revolutionaries are joined by a great many "concerned" phony brothers-in-arms, hypocritical advisers, soothsayers and "harbor pilots," who know to what submerged reefs it is easiest to steer this ship in full sail.

Calculation and Modeling in Mission Planning

90R10008B Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 89 (signed to press 6 Oct 89) pp 4-5, 24-25

[Article, published under the heading "Tactics and Simulation," by Docent Col V. Shubin, candidate of military sciences: "When Making a Decision"]

[Text] In the process of combat sortie planning the subunit commander as a rule considers several possible variations, seeking to choose the optimal one. A correct decision can be made in regard to the current situation only if its basic elements have been determined taking into account all factors affecting execution of the assigned mission. In the past it was comparatively easy for the commander to take them all into consideration, due to the fact that they were few in number. No special analysis methods were required. A speculative assessment grounded on personal experience proved to be quite sufficient.

As the development of weaponry progressed, the number of factors affecting the result of combat operations has increased substantially (see accompanying diagram). The majority of factors contain an active and conscious element of opposition or countermeasures, that is, they reflect the adversary's reaction or response, which cannot be fully taken into account, which also applies, for example, to weather conditions or terrain. The enemy's air defense assets, ECM resources, and air forces, exerting a combined effect, greatly complicate the task of choosing a correct operation variant and determining operation plan elements. This applies to distribution of forces among specified targets, selection of subunit formation parameters, etc.

In these conditions the commander needs more than experience alone. He needs knowledge of specialized methods which make it possible to trace the influence of each factor on a combat sortie during all mission phases and to obtain corresponding quantitative estimates. The calculation method and simulation or modeling are in widespread use at the present time.

The calculation method consists in determining individual elements of a commander's plan on the basis of formulas. For example, the required number of aircraft (N) to destroy a specific target is calculated as follows:

$$N = \frac{\ln(1 - P_{\text{ун}})}{\ln(1 - P_1 Q)}, \text{ где}$$

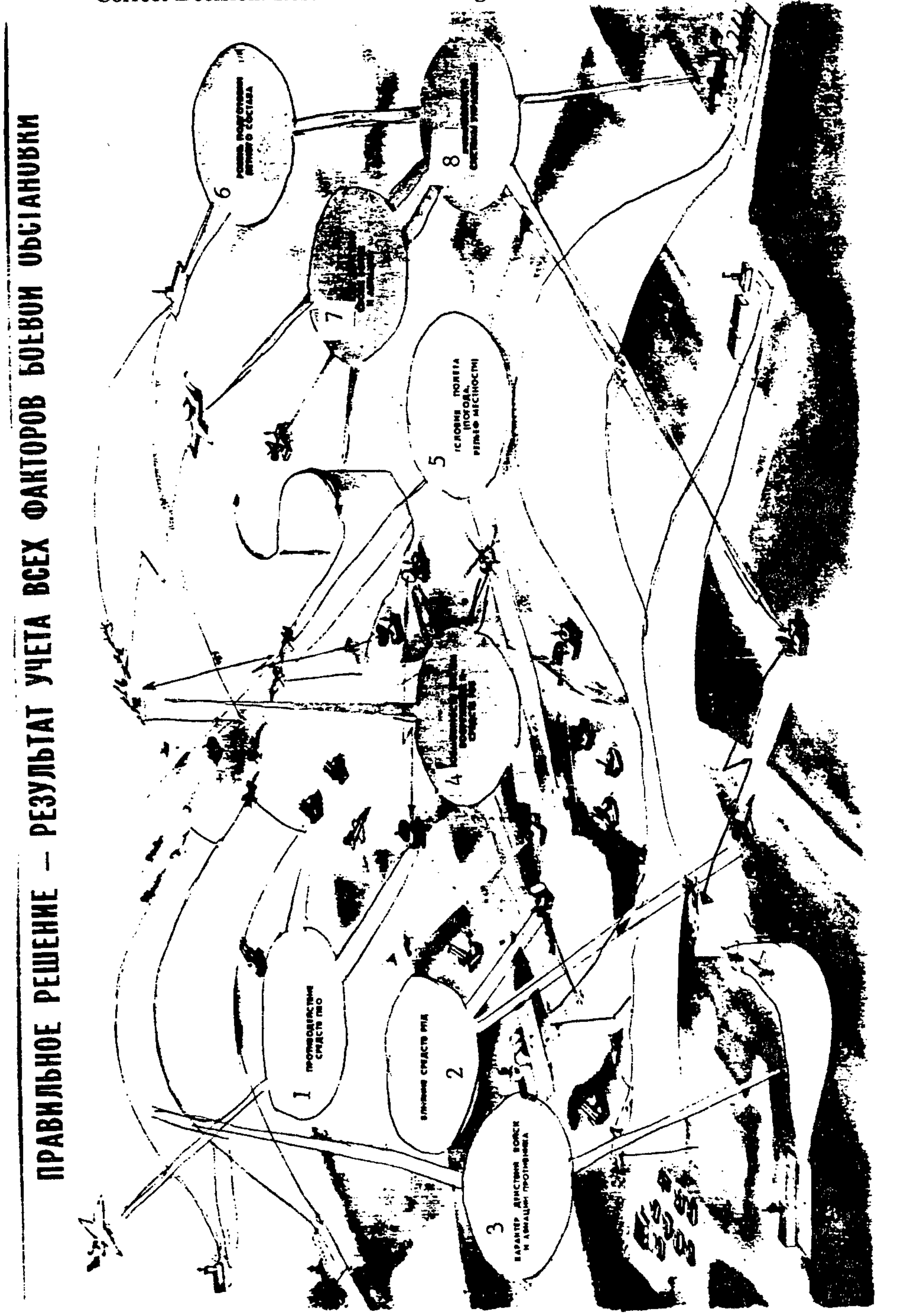
where P_{yH}—specified (required) target destruction probability; P_1—combat potential of one aircraft; Q—probability of successful penetration of hostile air defense.

This method is used when there exists an analytical relationship between planning decision elements and one or several situation factors, when the problem of selection of alternative variations does not arise, when it is not necessary to predict aircrew actions and their results.

Simulation or modeling is used in all other cases. Air-to-air combat, air-to-ground strike, and air defense penetration models are the principal models for air subunits. They can be mathematical or graphic-analytic.

Mathematical computer modeling makes it possible rapidly to perform a large volume of calculations and comprehensively to evaluate the influence of a large

Correct Decision: Result of Considering All Combat Situation Factors



Key:
1. Hostile air defense action
2. Influence of ECM assets
3. Nature of actions by enemy troops and aircraft
4. Capabilities of weapon systems and EW assets
5. Flight conditions (weather, terrain)
6. Level of aircrew proficiency
7. Nature of actions by friendly troops and aircraft
8. Command and control system capabilities

number of factors. It is not distinguished, however, by clarity of representation and fails to consider nonformalized elements such as the element of surprise, morale and fighting qualities, military stratagem, etc. On the other hand graphic-analytic simulation provides clear graphic visualization, and specific conditions of mission execution can be taken into consideration, but it is too laborious a technique. It is these advantages and drawbacks which determine the appropriateness of application of each of these methods at the decision-making and planning stage. Mathematical modeling is used when it is necessary in a practical and efficient manner to distribute available forces among missions, targets, and tactical elements, and to estimate the influence of various factors on the overall result. Graphic-analytic modeling is used when formulating the commander's concept, when determining the sequence of actions by individual force elements, and when selecting optimal formations and tactics, as well as their parameters.

The purpose of employing methods of quantitative plan substantiation is to obtain indices characterizing combat dynamics and results (strike delivery, air defense penetration, etc). The most important of these are the following: damage inflicted on the adversary; probability of accomplishing particular missions at various phases of the overall air mission.

The first indicator can assume various appearance. When delivering a strike on ground targets, it is expressed by the mathematical expectation of number of destroyed individual targets or the mathematical expectation of effectively-hit target area, and when combating threat aircraft—the mathematical expectation of number of downed aircraft (bombers, fighters, reconnaissance aircraft, etc). In the final analysis it determines in a most direct fashion the degree of achievement of the mission objective.

The second indicator comprises probability estimates of penetration of hostile air defense, detection of and arrival at a specified target, accomplishment of the attack, destruction of an individual target as a component of a multiple target, etc.

Only by thorough comparison can one select the optimal action variation for aircrews and force elements from a number of possible variations. It is essential skillfully to utilize existing criteria, since errors adversely affect the mission plan. For example, as criterion of effectiveness of fighter actions when escorting strike elements one can take the mathematical expectation of number of destroyed enemy fighters or the mathematical expectation of number of supported aircraft reaching the target. In this case preference should be given to the latter, for it unequivocally indicates how the fighters handled the assigned mission. The first criterion, however, fails to provide such information. And selection of a fighter action variation even with a fairly large value does not eliminate the possibility of substantial losses sustained by the escorted aircraft.

Individual elements of the selected action variation are also subject to comparative evaluation. One is sufficient in those cases where it fully describes the modeled process, that is, an exhaustive answer is given to the question of interest. Such instances include probability of successfully penetrating hostile air defense. The optimal variation will be that one with the greatest probability value.

One applies several criteria when the element in question is described by a number of conflicting indices. For example, determination of mission profile. Reducing altitude leads to increased probability of successful air defense penetration, but at the same time there is a decreased probability of detecting and coming over the target. Thus a decision is made as a rule on the basis of compromise.

Evaluation of the effectiveness of action variations can be not only quantitative but qualitative as well. The former is employed chiefly in the course of flight personnel combat training in peacetime, when it is possible to analyze each of them in detail and to select the best. After this it is practiced and perfected in the air and adopted into the tactical inventory.

The latter is performed in a combat situation when time is of the essence. It includes analysis of existing base variations into which adjustments have already been made for current conditions. Its execution presupposes that the commander possesses sufficient practical experience and a precise understanding of the nature of interlinkages among the factors affecting aircrews in flight and the combat mission result.

Qualitative assessment of variations begins in parallel with their elaboration, that is, in the process of formulating concepts, and continues in the course of simulation or modeling. It includes determination of degree of conformity between each variation and such requirements as ensuring that actions are undetected, achievement of offensive surprise, seizing of the initiative, stability of coordination, originality, etc. Following comparison, the worst of these are eliminated from further consideration.

At the modeling stage qualitative evaluation seeks to clarify the extent to which a mission execution variation is simple in implementation, advantageous from the standpoint of controlling aircrews, flexible, that is provides capability to adjust the mission during flight when the situation changes, and is stable against possible pilot errors. Variations which fail to meet these requirements are either rejected or are refined as necessary. Thus following simulation or modeling one obtains so-called base variations, each of which can be taken as a basis for the commander's plan. Subsequent evaluation (qualitative or quantitative) makes it possible to determine the optimal variation for specific conditions of combat mission execution.

Using Computers to Practice En-Route Navigation

90R10008C Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 89 (signed to press 6 Oct 89) pp 6-7

[Article, published under the heading "For a High Degree of Combat Readiness," by Lt Col G. Dudin, candidate of military sciences: "Effective Reserve"]

[Text] The most recent Paris Air Show at Le Bourget, at which Soviet aircraft were highly praised by foreign experts, eloquently attests to the level of development of our aviation technology. But one should not forget that the abacus and slide rule are living side by side in line units with modern aircraft systems, and laser-guided missiles are being hand-winched to their mounting pylons.

There is a fairly wide gap between the level of automation of aircraft, aircraft ground preparation and preflighting equipment, and personnel training. There are evidently certain general factors in play: a narrow, parochial attitude, absence of a systems approach and, finally, actions geared to show and pretense. As a result, in the course of preparing for flight operations, pilots and navigators perform various calculations using the simplest tools, fly aircraft equipped with several onboard digital computers, and subsequently process results with pencil and paper. A similar picture is observed with the conduct of training drills. For example, everyone is familiar with the method of rehearsing a flight by "walking it through." It is unquestionably a simple and clear-visualization technique, but it should not be a primary technique.

Fundamentally new means offering greater capabilities are needed in order to eliminate the disproportion between "ground" and "air." Today computers possess such means. For this reason the already-commenced process of equipping Air Force units with computers is presented as an entirely natural response to the existing situation. Without computers it is not possible to transition to qualitative parameters in combat training.

This progressive area of advance could reach a dead end, however, if the ways of accomplishing it are not precisely defined. What evokes the greatest concern? First of all the fact of considerable diversity among computers, their virtually total incompatibility, and lack of centralization of software. At the present time computer software is being developed in a haphazard manner. Of course initiative is needed in this endeavor. But everything connected with flight safety should be adopted only following comprehensive, thorough verification. This means that it is essential to establish at the outset what software may be used at one's discretion and what software should be used on the basis of official authorization. In my opinion instructional and games software should apply to the first category, while the second category should include software connected directly with the performance of flight operations. Otherwise there could be tragic outcomes, which would discredit computers and impede their utilization in line units.

We cannot allow this to happen, for computers possess enormous potential to accomplish qualitative transformation of all aspects of training. In confirmation we can cite the example of intensification of the process of training a navigator in nonautomated navigation.

No matter how sophisticated automatic navigation equipment may be, it unfortunately lacks absolute reliability. Equipment failure sometimes occurs. When this happens the navigator, left with a limited number of separate instruments and devices, is forced to shift to nonautomated navigation. He is characterized as a professional by the degree to which he is prepared to work in the emergency situations and conditions which develop during flight.

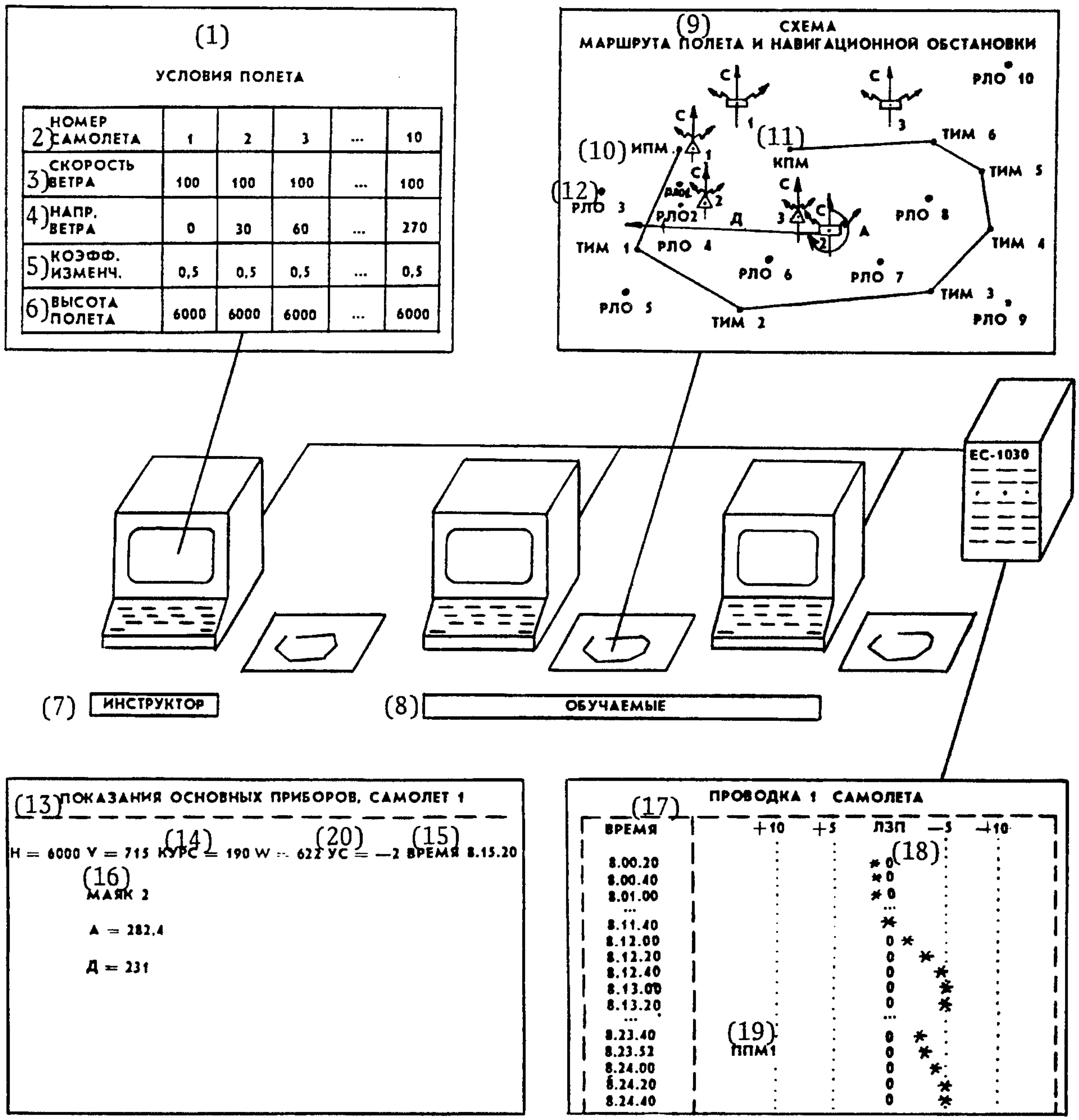
The ability to guide an aircraft along a prescribed route in any situation and to come onto the target at the designated time is of particular importance to the military navigator, since in a combat environment no equipment malfunctions can serve as justification for failure to accomplish the assigned mission. It is therefore not surprising that acquisition of thorough knowledge and solid skills in nonautomated navigation comprises the foundation of navigator training at Air Force schools. This is a long, laborious and, we must add, very costly process, since it presupposes a large number of training flights.

But with computers one can effectively conduct navigation training exercises on the ground. At the Military Air Academy imeni Yu. A. Gagarin, for example, they have developed software for simulating an aircraft flight, on a preselected route, with variable winds, for series YeS [Standard System] computers with various display systems. This software is successfully undergoing certification procedures at the Chelyabinsk and Voroshilovgrad Higher Military Aviation Schools for Navigators and at the Syzran Higher Military Aviation School for Pilots.

A training session is conducted under the direction of an instructor, who is positioned at one of the displays. Students are positioned at the other displays (see diagram). A "flight" on the computer, just as an actual flight, begins with preflight preparation. The instructor enters flight level, en-route wind direction and velocity, and time of approach to the target and informs the students of these input numbers. The students perform flight navigation calculations, determine and enter into the computer the course on the initial leg and airspeed required to reach the target at the specified time.

The "flight" then begins. A table is displayed on the screens (data for aircraft 1 are shown for purposes of illustration).

It contains the following instrument readings: altimeter, airspeed indicator, course indicator, DISS (groundspeed and drift angle), and clock. In addition, by indicating type of sensor (1, 2, 3) or control mode (4, 5), one can obtain ADF, RSBN, and airborne radar readings, and one can also enter heading and true airspeed.



Key:
1. Flight conditions
2. Aircraft number
3. Wind velocity
4. Wind direction
5. Variability factor
6. Flight altitude
7. Instructor
8. Students
9. Diagram of route and navigation environment
10. Mission departure point
11. Destination point
12. Radar reference point
13. Readings of principal instruments, aircraft 1
14. Heading
15. Time
16. Beacon
17. Aircraft tracking record
18. Intended track
19. Waypoint
20. Drift angle

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READINGS OF PRINCIPAL INSTRUMENTS,
           AIRCRAFT 1

H= 6000              V= 705
HEADING= 185         W= 602
DRIFT ANGLE= -1 TIME 8:00:24


   INDICATE TYPE OF SENSOR OR
          CONTROL MODE

1 -- ADF
2 -- RSBN [Local Radio
     Navigation System]
3 -- Airborne Radar
4 -- Enter Selected Heading
5 -- Enter Selected Airspeed
```

The students, guided by their flight plan, determine their position, perform required navigation calculations, and adjust heading and airspeed in order to hold to the intended track and reach the intended target. Let us say, for example, that we are to determine our "aircraft's" position according to the RSBN [Local Radio Navigation System] reading. We select number 2 and press ENTER. An instruction appears on the screen: "Enter RSBN beacon number." We should respond by indicating the number of the selected beacon and pressing ENTER. Bearing and range to the radio beacon from our "aircraft" are displayed on the screen. Applying these values to a navigation chart or a special diagram, we determine our position. A like procedure is used with the ADF and airborne radar.

Upon reaching a waypoint, the student selects mode 4 and enters the next leg's heading, upon which the "aircraft" turns to the selected heading with the prescribed bank angle.

All navigation instrument and navaid readings are given with random errors corresponding to their degree of operational accuracy. Execution of control commands by the "aircraft" (maintaining heading and airspeed) incorporates aircrew-inherent random errors, just as during an actual flight.

Each student flies his "aircraft" in his "own wind scheme," which varies randomly. The instructor sets the variability factor, thus determining the level of difficulty of the exercise. He can also switch off any of the navigation instruments and navaids, simulating in-flight failure.

When the "flight" is over, the computer generates a printout of the aircraft's position deviation from the intended track, in a form as shown in the diagram. A table is printed out for analysis of the student's flight performance, containing a report of student performance on the basis of readings and "aircraft" control. These materials, as well as personal navigation documents, provide fairly complete and objective data for "post-mission" critique and analysis.

Of course "electronic flight" cannot substitute for and certainly does not eliminate actual training flights. In particular, it does not provide the capability to work on such items as conduct of visual and radar position orientation. Two years of experience in conducting training sessions on the computer at the Chelyabinsk Higher Military Aviation School for Navigators, however, has dispelled all doubts. A survey of the students indicated that 92 percent of those polled positively rate their influence on the level of cadet navigational proficiency. Fourteen out of 23 instructors endorsed this type of training, only one was against it, while 8 did not specify. Results of a special study indicate that the use of such training sessions at the school makes it possible to cut actual student flying time logged by 30 hours without detriment to quality of navigation training (savings of approximately 800,000 rubles per year).

This example of using computers in training navigators is not the most spectacular or indicative, but it fairly persuasively confirms the considerable potential of computer hardware used in practical Air Force training.

Perestroyka and Promotion of Military Personnel

90R10008D Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 89 (signed to press 6 Oct 89) pp 8-9

[Article, published under the heading "Following a Policy of Perestroyka," by Lt Gen Avn Yu. Simakhin, chief, Air Force Personnel Directorate: "Right to Promotion"]

[Text] Perestroyka in the Air Force and orientation of its development toward primarily qualitative parameters place new demands on the officer corps. Modern, all-around professional training, thorough knowledge in matters of tactics, hardware, command and control, military education science and technology are required today to a greater extent than at any time in the past. In the final analysis, and this was stated at the USSR Congress of People's Deputies, success of perestroyka depends to a determining degree on how deeply our cadres grasp the need for changes, how innovatively and purposefully they accomplish the new, large-scope tasks facing us. It was also noted at the Congress that mere follow-through and conscientiousness are no longer sufficient. Perestroyka calls for an increase in the significance of such qualities as a sense of the new, initiative, and boldness.

V. I. Lenin taught that one should approach work with cadres primarily from a political standpoint, viewing it

in an inseparable linkage with the essence of the problems to be resolved at the given stage, selecting cadres "according to new measures, in conformity with the new tasks." This is why whenever the matter at hand is nomination to a leadership position, not only a person's professional qualities and ability to lead others are carefully studied and thoroughly weighed. Political qualities and the future leader's attitude toward perestroyka and the tasks of accelerating our country's socioeconomic development constitute a decisive criterion. We are talking about attitude not in words but in deeds. And the more responsible a position is, the higher are the demands imposed on the candidate. We should not be just "nice guys" in this regard.

Genuine concern about selecting people for command positions has nothing in common with complacency and all-forgiveness, with charitableness and indulgence, and this is understandable. In any military unit—from weapon crew to large strategic formation—the commander is the central figure. Combat readiness and the moral and ethical atmosphere in the unit depend in large measure precisely on the one-man commander. And achievement of victory depends on the commander in a combat situation.

Our Air Force possesses a highly-skilled, ideologically mature officer corps which is thoroughly trained both militarily and politically. At the same time there exist both reserve potential and unresolved problems in the multifaceted work pertaining to selection and placement of cadres of military councils, headquarters staffs, political agencies, and party organizations.

Perhaps the most difficult thing at the present time is to overcome inertia, the tendency to operate using the former methods which we have inherited from the period of stagnation. Instances of procrastination and irresponsibility have not yet been entirely rooted out. Sometimes there is an extended delay before recommendations are implemented. While on the lists of candidates for promotion, officers remain in their former slot, as if in the shadows. Maj N. Mushenkov, for example, was formally recommended back in 1986 for promotion to the position of regimental senior navigation officer. He is still in his former position, however. Air squadron commander Lt Col V. Palchevskiy was recommended for promotion that same year, but he too has not yet been promoted. Regimental navigation officer V. Tarasenko also has not been promoted to a higher position, in spite of the recommendations in his efficiency report. This list goes on and on.

Such a cool attitude, to state it in mild terms, on the part of superiors toward the fate of their subordinates is of course not at all beneficial. On the contrary, it causes resentment, less work effort, has an adverse effect on work performance, and engenders various negative opinions.

Things are also aggravated by the fact that in time an officer who has been previously recommended for promotion loses his career prospects, and steps are taken to retire him either by reason of age or for other reasons. Maj V. Stepanov, for example, who in 1986 was recommended for promotion to the position of squadron deputy commander, has now been recommended for discharge into the reserves without carrying out the formal recommendation of promotion. Gds Capt V. Kruglov, who was recommended two years ago for the position of regimental engineer, has submitted a formal request for separation from the Armed Forces. Unfortunately these are not isolated examples. This gives rise to conflicts.

Of course it is not for the sake of honors and higher positions that officers carry out their duty to the homeland in a worthy and honorable manner and strengthen the operational readiness of Air Force subunits and units. This is persuasively confirmed by the selfless labor of pilots, Aviation Engineer Service specialists and other personnel who carried out their internationalist duty in the republic of Afghanistan. More than 30,000 Air Force men were awarded government decorations for military valor, courage and heroism, and more than 20 of these were awarded the title Hero of the Soviet Union (seven posthumously).

Air Force personnel display good performance results in peacetime as well. For example, pilots who were led into "battle" by holder of the Order of Lenin and the Order of the Red Star Lt Col Yu. Beldiyev distinguished themselves at a Moscow Military District field training exercise. Operating in adverse weather, these military aviators conducted air reconnaissance, flew strikes on "enemy" command and control facilities, and provided ground troops with effective air cover.

The entire life and activities of Air Force personnel are filled with such examples. Personnel agency officers constantly feel the intensive pulse of military life and the complexity of the processes of restructuring and renewal which are going on. This makes it possible to evaluate in a competent and objective manner the performance of personnel in the complex conditions of training exercises and scheduled flight operations. Here they become more closely acquainted with pilots, navigators, engineers, technicians, rear services and liaison officers, answer questions of interest to these personnel, become better acquainted with their daily life and activities, and clear up unresolved problems.

And a great many issues arise. Some officers are unhappy with the fact that their expectations have not come to pass and that their prospects have not been realized. Others have complaints to lodge that they are being kept unwarrantedly long in duty assignments at remote locations with bad climatic conditions. Some are worried about the forthcoming reduction in the Armed Forces. They wonder what consequences it will bring, and they wonder if it will be a repeat of the 1960's.

These and many other problems which accumulated over the years remained ignored and unresolved for a long period of time. Why is this? I believe that the main reason lies in the weakness of democratic elements in personnel work.

The new style evident in the activities of personnel agencies gives reason to hope that new energy will be devoted to resolving these matters. We are seeing new approaches and greater objectivity in assessing specific actions. As we increase demandingness on individuals promoted to leader positions, we must persistently implement the party policy aimed at broadening glasnost and democratization, at ensuring legality and social justice in determining personnel matters. This is an essential condition in our work.

Such forms of democracy as brigade, shop, and workforce councils and, in the military environment—officer assemblies, permanent certification boards, and community meetings, at which matters connected with promotions are discussed, are taking increasingly deeper root in our lives. All this makes it possible to approach each officer thoughtfully, in the spirit of the times, and to assist commanders and other superior officers in objective evaluation of the ideological fitness, job proficiency and organizing abilities of future leaders.

Such a work form as personnel performance evaluation and preparation of efficiency reports is extensively used in order promptly and efficiently to assess officers' political, job-related, and moral qualities. The main objective of this process at the present stage is to determine officer service needs in conditions of reduction of the Armed Forces. This work must become a point of departure in future improvement of the indoctrination of military cadres and in increasing their job-related activeness and level of political awareness. We must seek to ensure that each and every subject of an efficiency report evaluation endeavors to perform his duties in a conscientious manner, displays an example on the job, in discipline and when off duty, constantly and continuously improves himself, and meaningfully participates in the activities of the party and Komsomol organizations.

Practical implementation of this can be accomplished only if decisions in personnel matters are grounded on democratic, fair and just forms and methods. It is essential to work hard to eliminate everything inherited from the period of stagnation. It is extremely important to avoid predictable pattern and excessive attention to form with detriment to content. We must reject a mechanical approach to promoting individuals to higher positions. Each candidate should be tested with a unique "indicator of perestroyka"—for his ability to think in the new manner, to see the near and longer-term future of his job activity and, most important, provide practical proof of his right to promotion.

Efficiency reports should contain no expressions or phrases of a general nature, which fail to reflect an officer's diversified job-related activities, his role and place in the collective, and his personal contribution to perestroyka in his assigned work area.

Whenever I visit line units, I always pay particular attention to the work style and methods of personnel agencies. And I always see that where tasks are performed in an atmosphere of glasnost, with integrity, with fairness, justice and openness, there are fewer mistakes in job-related activity, and ways to correct shortcomings or errors of omission are sought in a well-wishing atmosphere.

This is the correct way to go. It exerts positive influence on forming a healthy moral and ethical climate in the military unit, ensures prompt, timely, truthful information on work with personnel, and serves to block various false rumors and subjective fabrications. Correct procedures are being followed by those commanders and superiors who, when preparing efficiency reports, endeavor more fully to utilize the permanent certification boards, officer assemblies, party and Komsomol meetings. These democratic elements in work with personnel make it possible to reduce mistakes to a minimum in recommending officers for promotion to higher positions, in making transfers to new duty assignments, in making rank promotions and in awarding decorations.

Col A. Kozhemyako and Lt Col N. Antamonov, for example, are doing a fine job of directing permanent certification boards. All personnel matters are settled collectively, with open doors, as they say, taking community opinion into consideration. This promotes comprehensive, fair and just discussion and helps them reach the correct decision.

At the same time, however, democratization of personnel policy has its own specific features within the Armed Forces, features which one must consider. The specifics of military service are such that our Armed Forces are grounded on the principle of one-man command. It must therefore be skillfully combined with democracy and glasnost. Each serviceman, as he performs his difficult job, should at all times be aware of his commander's concern and attention and should well understand the social significance of his labor, performing not out of fear but by conscience his duties pertaining to defense of the socialist homeland.

Unfortunately there are still military units in which democratization and glasnost have not yet experienced adequate development. This was the case in the units in which the certification boards are headed by Col V. Ovsyankin and Lt Col V. Gubanov. The situation was corrected only following intervention by the higher-echelon personnel agency.

Practical experience indicates that a reliable body of candidates for promotion can be established and the task of strengthening the leadership echelon, the body of staff officers and military educational institution faculties can be accomplished only by rigorously implementing the Leninist principles of cadre selection and placement,

maximally taking into account the opinion of party organizations, permanent certification boards, and officer assemblies. They are proceeding correctly in those units where an atmosphere of proper demandingness and concern for one's subordinates is created, where friendship, mutual trust and cohesiveness are developed in mutual relations among officer personnel, and where every effort is made to boost one's sense of officer dignity and civilized intercommunication. At the present stage it is also important to be sensitive and solicitous in placing ethnic cadres, taking into consideration actual current interethnic relations.

Here is another important item. Today more than ever before it is necessary constantly and continuously to work with individual officers and warrant officers soon to be released from the Armed Forces, as well as with the members of their families. Personnel about to be discharged should be briefed on their rights and preferential treatment pertaining to obtaining a job, financial benefits, and procedure for obtaining housing. Discharge of all military personnel should involve a festive ceremony.

Decisions of the 27th CPSU Congress, the 19th All-Union Party Conference, and the USSR Congress of People's Deputies focus us on making sure that personnel policy maximally fosters and promotes the perestroyka which is taking place in this country. For this reason the right to promotion is earned today by those who are not afraid to take responsibility, who are capable of working long and hard at their assigned job, who are capable of finding novel, innovative solutions, and not only finding solutions but working persistently to implement them.

Jet Fighter Pilot Describes in-Flight Emergencies

90R10008E Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 89 (signed to press 6 Oct 89) pp 10-12

[Article, published under the heading "Flight Safety and the Human Factor," by Military Pilot 1st Class Maj V. Parkhomenko: "'This Is What Flying Means to Me'"]

[Text] **Military Pilot 1st Class Maj V. Parkhomenko tells about some psychological aspects of his work.**

* * *

In order that the reader not get the false impression that we pilots who fly modern aircraft are forced from time to time to cope with all kinds of in-flight failures of systems and components, I shall state right at the outset that this is not the case. The airplanes we fly are reliable. My comments focus on unusual (rare) incidents specifically for the purpose of providing greater contrast and emphasis in presenting certain psychological elements of flying.

The Shortest Flight

...A field training exercise was in progress. We were at a field strip. It was hot. There were no trees, bushes, or even a blade of grass. We were constantly thirsty. The sun did not simply beat down; it blasted right through you. There was no place to hide under the plexiglass canopy. I consoled myself with the thought that it would get better after takeoff: the air conditioner would kick in.

The aircraft's automatic systems truly work wonders. The outside air temperature is about +50° Celsius, but it is quite comfortable in the cockpit.

A command came over my headset: "541, go!"

I had been ready for departure for some time. The engines fired up one after the other. Engine ignition is automatic, with the engines firing up in strict sequence—that is how the designers arranged it. I recalled how in the old days we had to manipulate the fuel control on the nimble MiG-17. One's left hand was constantly "trying to feel" how much fuel to spray into the burner. If you did not spray enough, the engine would not start, and if you sprayed too much, it could overheat, and even catch on fire. You also enlisted your sense of hearing, which was "trained" to catch the finer shadings in the crescendo of the spooling-up turbine.

At that time we could not even conceive of the possibility that within such a short time this miracle of aviation technology—this fighter—would be created. During the seconds in which various computers were readying the aircraft's systems, I once again went over in my mind different variations of the forthcoming "combat engagement," while continuously monitoring the operation of the sophisticated automated systems.

I taxied my fighter over to the runway. I wanted to get into the air as soon as possible, but I had to wait—a two-ship element was on final approach.

The six landing lights, brightly sparkling even in the blazing sun, created the impression of some kind of fantastic scene. Wingtip to wingtip, soundlessly rocking in the heat-thinned air, the aircraft were growing in size literally before my eyes. I could now see their red stars and hull numbers. They touched down lightly.

Every time I watch somebody else landing, I mentally go through the landing procedure. My instructor's words are etched deeply into my very soul: "Consider one out of every 100 landings you see to be your own."

A green light from the "biscuit gun," and I taxied out onto the runway. My mind was focused on the task at hand. There was no room for extraneous thoughts. I was readying for takeoff. Following the takeoff procedures sequence, which had long since become automatic, I checked the instruments one more time. Everything was normal. Extend flaps. Advance throttle. I glanced out ahead; the runway was clear. I had been cleared for takeoff. I released the brake. The aircraft, sensing freedom, raised its nose. Airspeed was building up slowly, very slowly—the elevated air temperature was

having an effect. Of course I could take off with afterburners, but this was an unnecessary waste of fuel, and it would not hurt to have a fuel reserve in the forthcoming air-to-air "combat."

Be patient! Don't hurry things! Raising the nose means additional drag. I must wait for the proper airspeed at which to rotate. I check to make sure that the throttle lever is firewalled, although I am virtually certain that it is. This is indicated by the rpm and exhaust gas temperature readings. But when you can already see the runway end approaching and your nose wheel is still down, it is hard to maintain your composure and keep from rechecking what you have already checked.

It was finally time to pull back on the stick. The aircraft's nose rose slowly, as if reluctantly. The wheels were still in contact with the runway. Airspeed was increasing more rapidly. Liftoff! Once again, patience—I took my time with increasing the angle of climb. I remembered that I was carrying a belly tank as well as missiles on my wing pylons. I paid closer attention to airspeed. It was increasing, in spite of the heavy aircraft and the heat.

It was time to raise the gear. As I extended my hand toward the gear switch, I watched as the aircraft continued smoothly climbing. Then things started happening.

It was like a bolt out of the blue. One would think that you would be psychologically prepared at all times for any situation—that is the kind of job it is, but nevertheless the sudden and unexpected appearance of additional information always forces one to perceive time differently. The seconds begin to drag out. You are able to do what in ordinary circumstances would take much more time.

The master warning button red light began flashing. My brain, which had not yet taken in the full situation, had already issued the only possible correct (as was later determined) command to leave the gear down. At a height of 10 to 15 meters above the ground, and at low airspeed with full flaps, there is nothing you can do but continue climbing. Maintaining my angle of climb and monitoring airspeed (once again airspeed—that indispensable element!), I glanced over toward the right side of the cockpit. All information on systems status is concentrated there. In an emergency situation aural warnings make things easier. A soothing female voice informed me: "Aircraft accessories housing oil. Reduce throttle." I said to myself: "I am not dumb enough to throttle back. I am close to the ground, and airspeed is only 330."

But her calmness brought my tension down. My irritation faded. Down on the ground they were still unaware of what had happened. Within less than a second I assessed the seriousness of the situation. The aircraft accessories housing meant aircraft control. The controls could jam at any minute, and then.... At best I would be able to eject.

I radioed a brief situation report to the flight operations officer: "This is 541, aircraft accessories housing oil malfunction. Set up for downwind landing!"

I nosed the aircraft over to level flight. This would help maintain airspeed at minimum rpm. Here is where the ability to have a sensitive feel of the heavy fighter at low airspeed would come in handy. It was a good thing that Col A. Troshchev had "tormented" us with check rides on the eve of the exercise! Not words (there was no time for that) but rather a feeling of gratitude to my mentor flashed through my mind.

My radioed report caused quite a stir on the ground. Everybody else kept off the radio. They realized the seriousness of the situation. It is for good reason that the aircraft accessories housing and fire warning lights are located practically side by side on the emergency warning panel. I commenced a left turn and immediately began turning to my final heading inbound.

The flight operations officer warned me as he cleared me to land: "Emergency arrester barricade net is up; cross runway threshold high."

I realized that the airfield emergency arrester barrier net was one more hindrance, but I knew that they would simply not have time to lower it.

I nursed the aircraft back toward the field. Still close to gross takeoff weight, the aircraft was having trouble making the approach. I could sense this. I was grateful for the flight operations officer's assistance. He was facing the same unpleasant prospect, because the more time goes by following the warning, the more probable control failure will be.

As I was making my turn to the landing approaching heading I tried to gain a little altitude—it would help on the landing approach. I was able to gain a little altitude, but now I was already on final. Out ahead was the airfield emergency arrester barricade net, and beyond it the runway end, which was now the runway threshold. Now began a moment of total oneness with the aircraft, when it was almost impossible to distinguish between what I was doing and what the aircraft systems were doing.

The flight operations officer shouted (it was too much for his nerves): "Advance your throttle!"

My airspeed was a bit high. I wanted to maintain a safety margin for the extra weight and for the air temperature. I also initiated my flare while still a little hot. I pulled the stick back, but the air was so thin from the heat that there was simply no response. I continued settling, almost falling, at the same angle. I almost firewalled the throttles. The nose came up. My sink rate slowed to normal. I touched down. We were back on the ground—my airplane and me!

We were really moving! I could feel down to my very gut how difficult it was for the aircraft to stay on the runway. The slightest foot movement, and the aircraft would

commence wide excursions from side to side. We were moving fast, and therefore the controls were more responsive. This realization came later, it is true, when the situation was analyzed. But at present only experience was "working."

Only the drag chute could help now, but just try to release it at this speed. It would rip away. We were still moving too fast.

Be patient. Take your time! I waited, and then released the brake chute. It did not tear away. After that it was routine.

I taxied off the runway. It had to be cleared, because I was not the only one in the air. No matter how difficult things become, you must always think about your comrades who are still aloft.

I braked to a stop, shut down the engines, and opened the canopy. The oven-like air seemed cool. Would wonders never cease? I noticed that my knees were shaking from the tension. I glanced at the clock out of habit. I could not believe my eyes: only 40 seconds had passed since takeoff!

Love, the Sky, and Stress

...It suddenly became dark in the cockpit. We were at an altitude of just under 1,000 meters. Our fighter trainer had entered the clouds. I shifted to flying on instruments. My eyes became accustomed to the darkness and I could clearly see the instrument readings.

The fighter was pegged on final. We reached the gear extension point. The three lights lit up, and the entire fuselage shook slightly. I added throttle and extended flaps. The flap indicator lights winked on. The next thing was to report to the tower that all landing checklist procedures were completed. But I had a feeling something was wrong.

I barely noticed the word "Memory" lit up on the annuciator display. This usually indicates that airspeed is a bit high and that the control system has not transitioned to landing mode. I glanced at the airspeed indicator. Airspeed was normal! What did it mean? We were approaching the outer compass locator. We were not more than a minute and a half from touchdown.

Response under time stress is amazing! The brain works like a computer. I formulated a plan of action. I reported the situation to the tower. We proceeded to work in response to the problem, just as we had done on the cockpit simulator.

We were not worried, because the regimental commander was working the flight operations officer position. He queried us about fuel remaining, and we proceeded to consider the possibility of executing a missed approach and going around. We reported the rapidly-changing situation to the tower.

Soon the warning "Memory" became clear. The words "Extend Gear" appeared on the annunciator display. We peered at the gear status lights. Pressure in the hydraulic systems was normal. What was the problem? We later learned that it was a warning system malfunction.

The marker beacon receiver proceeded to beep. We passed the outer marker. Height was now 200 meters. We were still in clouds. And below the clouds were rain and haze. In this kind of weather a fuel reserve is absolutely essential. But we had no desire whatsoever to shoot a second approach!

Lt Col V. Uvarov kept the needles centered: after all, he was a flight instructor. I was in the forward cockpit, handling the cockpit procedures and working the radio. I deployed the landing lights. Our fighter appeared out of the gloom in thick haze just before flare initiation point. The flight operations officer cleared us to land and reported reassuringly: "I see three landing lights, gear down, go ahead and land! Everything normal!"

I reduced throttle. The aircraft reached the touchdown zone, and touched down softly.

Soon a seemingly insignificant entry will appear in the flight log: "False malfunction warning." Within a few days nobody will remember the incident except for those who were sitting in the cockpit and the one who cleared them to land. False malfunction warning! This results in gray hair to young pilots who totally love their job. But the sky has made them into men, and they are boundlessly devoted to it, no matter what. Forever!

Thirty Seconds After Landing

I was about to land. The fighter was approaching the runway threshold. Following practiced habit, my hand reached toward the drag chute button. My index finger was already touching it, but was waiting for a command. And the command could not come until I visually checked to make sure that it was the right button, although at this time my eyes were busy watching to ensure that the aircraft maintained alignment with the runway centerline. The runway does not seem very wide when you are traveling about 300 km/h.

My peripheral vision picked up runway lights flashing past. One could consider 10 percent of the job done.

I punched the button, and "half" of my gaze was now focused on the rear-view mirrors, which were squealing and shaking (an aerodynamicist would say: "Deceleration is in progress"). The wheels contacted the rough concrete. The button had been punched, but the parachute does not pop out immediately. You know this, and yet every time you wait nervously and prepared to act in case of failure to deploy. The runway seems long to those who sweep it of snow, sand, and dust, but it always seems short to the pilot. For this reason one's nerves are fully taut.

Dozens of thoughts run through one's head by the time the parachute pops out and billows open. As a rule you

recall instances when for some reason the parachute failed to deploy (during your career you have flown various types of aircraft). You think through your actions automatically, as it were. You even begin to stroke the brake lever, and you seek out with your gaze the emergency brake handle. A thought flashes through your mind: I wish I were already on the ramp.

But then came that pleasant tug: everything was working normally. Your shoulders cut into the restraining straps, and if the flight helmet is a poor fit (a trivial matter, one might think), it will slip down over your eyes by inertia. And then if a tire blows, they will say sorrowfully: "The guy had bad luck...."

Enough of this! The parachute is temporarily forgotten. New thoughts, new concerns, new actions. The brake lever will help come to a stop before reaching the end of the runway. Just like a skier, one maintains directional control by applying pressure to the rudder pedals. The aircraft is supposed to hold to the runway centerline. I retract the landing light. It has done its job. I spotted some birds flying by the runway as the aircraft rolled past. I retracted flaps. But the swift fighter kept rolling.

Only 10 seconds had passed since my wheels had touched the concrete. The slower the speed and the closer the taxiway turnoff, the more concentrated a pilot becomes. All's well that ends well, as they say.

In the meantime my attention is fully focused on the runway. I reached the helpful arrow, prompting me: "Turn here!" I pushed hard right pedal, and the aircraft's nose obediently swung to the right. It was time to drop the drag chute. I periodically applied the brakes with my right hand, switched off auto mode, adjusted trim, and reset my navigation system. I do all this virtually by feel. At any moment the aircraft could run a wheel off the concrete into the mud. I therefore keep an eye on the "road."

I manipulate the thrust levers with my left hand, almost continuously press the nose wheel steering control button, and at the same time drop my drag chute. This is no simple task. It requires skill. My colleagues once mused jokingly in this regard: I wonder if Julius Caesar could have handled all these operations simultaneously?

The fighter was nearing the ramp, although there were still a number of turns to negotiate. The ground crew was impatiently waiting, to service it for the next sortie....

Proposed Air Force Computerized Flight Safety Information System

90R10008F Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 89 (signed to press 6 Oct 89) pp 12-13

[Article, published under the heading "Effectively Using Scientific Potential," by Maj Gen Avn A. Batalov: "Safety Automated Information System"]

[Text] At the present time a large amount of information on flight safety is circulating within the Air Force, information which requires thorough, detailed analysis in order to enable us to make decisions in a prompt and efficient manner.

This information is quite diversified in composition, content, and form, and is sometimes contradictory as well. According to malfunction record cards, for example, in the last 10 years MiG-23 and MiG-27 aircraft have experienced 63 in-flight emergencies due to spontaneous drag chute deployment during flight, while the number of such incidents totals 163 according to other data. Such conflictiveness of data adversely affects promptness and quality of preventive measures, which is confirmed by continuing incidents of spontaneous drag chute release on aircraft of this type.

Obviously efficient and effective utilization of all available data on the problem of flight safety is possible only if such data is assembled and classified using electronic means of automation. These goals can be achieved by creating an automated information system utilizing modern equipment and techniques of collecting, storing, and promptly processing data.

This problem has long since been resolved in practically all developed capitalist countries (United States, Great Britain, West Germany, Canada, etc). ICAO, the International Civil Aviation Organization, for example, has been operating an automated data management system since 1976. The Ministry of Civil Aviation's Safety Automated Management System began operating in this country at that same time. The Air Force also badly needs such a system. The principal purpose of such a system should be achievement of a substantial improvement in the effectiveness of preventive measures to reduce the accident rate by more prompt and timely adoption of practical, scientifically substantiated decisions pertaining to ensuring flight safety.

The principal tasks which should be pursued would be the collection, storage and processing of information on air accidents, near-accident situations and in-flight emergencies; determination of the causes and factors exerting the greatest influence on flight safety. It will also be possible to do a better job of evaluating flight safety indices and indicators of effectiveness of executed and planned preventive measures, and to predict accident rate by groups of factors. All these materials would be available on request by command authorities as well as when investigating air accidents and in training personnel.

What are the principal conditions which determine the effectiveness of functioning of a proposed automated information system?

First of all we need more thorough statistical analysis of flight safety by greatly increasing the number of air accident and near-mishap characteristics subjected to analysis, as well as including in analysis as much data as possible on aircraft reliability. Utilization of computer

analysis in combination with modern mathematical methods will make it possible to study a maximum of available data on the circumstances of air accidents (near-accident incidents and in-flight emergencies), the characteristics of level of flight personnel proficiency and response in emergency situations, as well as data on equipment and organization of its operation and maintenance. Approximately 200 different parameters are recorded for each air accident, for example, in the Ministry of Civil Aviation's currently-operating automated flight safety data management system. Preparation of a formalized report document on an air accident or near-accident incident provides capability to perform a thorough analysis of each such incident.

Using computers will make it possible to increase promptness and efficiency of analysis and elaboration of measures to prevent accidents and accident-threatening incidents by reducing information processing time.

There will also be increased reliability of determination of causes of accidents (near accidents) by utilizing capability to draw on a large volume of information, the need for which arises in the process of accident investigation, and utilization of modern mathematical methods of determining the causes of accidents. Informational materials describing air accidents in detail can be provided on request.

Another important advantage of an automated information system will be an increase in information reliability through organization of data on air accidents (near accidents) received from Air Force units, as well as increased responsibility for information, since data will be analyzed when entered into the computer. Evaluation of these data indicated that at the present time they differ significantly both in quantity and content. The number of cards recording near-mishap incidents due to equipment failure on file at various echelons varied by a factor of 1.5 to 2 from one year to another, and approximately 50 percent of this information could not be correlated. Such statistics of course make it impossible to determine the actual state of affairs in Air Force units and combined units and diminishes the effectiveness of preventive measures.

Using an automated system opens up the possibility of exchange of information between computers, with automated systems of other agencies, such as the automated data management systems of the Ministry of Aviation Industry and Ministry of Civil Aviation. This will make it possible to draw on large additional volumes of data at minimum cost of data entry, and will also make it possible rigorously to monitor execution of measures conducted by the Ministry of Aviation Industry aimed at eliminating cases of aircraft equipment failure.

As the automated information system further develops and as units become equipped with computers, it would be possible fundamentally to alter the form of presentation of materials intended for increasing the proficiency of flight and engineer personnel. It will be possible to establish a collection of information on computer storage media (diskettes, magnetic tapes), which the computer can present not only as text data but in a form reproducing the dynamics of development of emergency situations on the computer display. Such an approach can substantially increase the effectiveness of the instructional process.

And, finally, there is also another important factor. An automated information system should become an essential element of a future computer flight safety expert system utilizing the advantages of modern computers. This system, in combination with specially developed software, will make it possible to draw up scientifically-validated proposals for eliminating or diminishing the effect of the most significant factors affecting flight safety.

Certain prerequisites already exist for establishing a Safety automated information system in the Air Force. For example, an automated system has been developed for identifying the causes of aircraft equipment malfunctions on the basis of various symptoms revealed in the course of investigating an aircraft accident; a reference information system based on the results of investigations of aircraft equipment which has failed or malfunctioned has been established; a computer information system for processing data on reliability of aircraft equipment on the basis of malfunction record cards is successfully operating.

Of considerable importance for utilizing all the advantages of automated data processing in the process of safety management is organization of an automated information system which incorporates rigorous control and regulation of actions, formal legal statement of the rights and obligations of subunits participating in the process of collecting, processing, and utilizing information, and determining manner and procedure of their interaction and process of documentation.

In our opinion the structure of an automated system could be as follows: the main element performs collection, storage, and processing of incoming information and communication of problem solutions to user entities. Analysis and recording of input documents would be performed at this level. Main element subdivisions would ensure uninterrupted operation of computer assets, would produce and improve software in the process of automated information system operation and development. They would develop mathematical methods and produce software for problem solving in conformity with assignments received from Air Force officials, and they would ensure reliability, prompt and timely delivery of results. In addition, interaction with automated management systems of other agencies would be accomplished at this level. The following components form the input information stream: formalized data on aircraft accidents, near mishaps and in-flight emergencies received from the line units; data on the most serious aircraft equipment malfunctions revealed in the

process of equipment overhaul and maintenance at aircraft maintenance depots; information on measures taken in line units and in industry to prevent aircraft accidents and mishap-threatening incidents, as well as on aircraft equipment malfunctions and failures discovered at industrial enterprises. These data come from the Ministry of Aviation Industry's Reliability Automated Data Management System.

Data on aircraft accidents and near-mishap situations, categorized by types of aircraft in service with the Air Force, are received from the Ministry of Civil Aviation's Safety Automated Data Management System. Information on aircraft equipment reliability is received separately from an automated equipment malfunction card records system, as well as on results of research conducted at scientific research establishments and at Air Force higher educational institutions, which can be utilized to increase flight safety.

Data received by the main component, after processing, would be provided to users, particularly Air Force leader personnel and flight safety service specialist personnel. In addition, information could be provided to the USSR Council of Ministers State Commission on Military Industry Affairs, Gosavianadzor, scientific research establishments and the Air Force's higher educational institutions directorate. Data on aircraft accidents and near-mishap incidents involving equipment failure would be forwarded to Ministry of Aviation Industry enterprises and organizations.

I believe that the effectiveness of the Air Force automated safety information system will depend in large measure on the overall level of practical adoption of computers in command and control, as well as on the availability of communications between the computers used in various automated management systems.

We feel that it makes sense to set up such a system in two stages. Initially, utilizing an existing computer system, we can organize processing of information on aircraft accidents, near accidents, in-flight emergencies, and measures to increase flight safety, on the basis of data received by usual channels. At the first stage the Air Force's Safety Automated Information System will provide information to all users in a form convenient for analysis—in the form of printouts or on computer storage media. The Ministry of Civil Aviation's Safety Automated Data Management System and the Air Force's system to analyze data on aircraft equipment malfunctions are organized in a similar manner.

One can subsequently establish an integrated automated system for collection and analysis of information on aircraft accidents, near accidents, in-flight emergencies, aircraft equipment failures and malfunctions, and preventive measures, based on a computer network. This system would also be established in two stages. Initially it will include main-component computers and microcomputers of Air Force large strategic formations and services. Subsequently Air Force regiment PC's would be linked into the system. Such a system could be operating at full scope in the near future. Using such a system, on the basis of intercomputer information exchange between the computer system of scientific research establishments and computers in Air Force services, large strategic formations and units, data could be transferred on practically a real-time basis (over a period of 24 to 48 hours).

In order to accomplish effective implementation of the idea of an Air Force Safety automated information system in 1990-1991, in our opinion it is necessary to draw up and ratify new provisions and methods governing the process of collection of information on aircraft accidents, near accidents, in-flight emergencies, and measures to ensure flight safety for Air Force units, interested subdivisions of the Ministry of Defense, and Ministry of Aviation Industry organizations.

At the second stage of development of the Air Force's Safety automated information system, development must proceed in such a manner that it becomes an integral part of the entire aggregate of activities pertaining to adoption of an Air Force automated management system. This will make it possible to use a common computer network and common network operating software for all automated management systems, as well as substantially reducing costs and shortening the timetable for accomplishing the second phase of the Air Force's Safety automated information system.

In the interests of accomplishing these tasks it is important first and foremost to provide for linking the software of the Safety Automated Information System and the automated control system being developed for command and control of Air Force equipment and armament. It is necessary to devise methods of solution and required software for collecting and processing flight safety information. This will make it possible to use a single integrated computer network for both systems.

In order to organize an integrated computer network supporting the operation of all automated systems mentioned above, including the Safety Automated Information System, it is necessary to provide the requisite number of personal computers in 1990-1995 to line units, combined units and interested Air Force organizations.

In addition to matters pertaining to organization and support of facilities (computers, organization of an integral computer network in the Air Force), effectiveness of operation of the Air Force's Safety automated information system will be determined in large measure by methodological, mathematical, and software support. All this must be accomplished as soon as possible.

Establishment of an automated information system is a complex, comprehensive task. Its successful accomplishment will require the joint efforts of scientific research establishments, Air Force educational institutions and services, particularly those dealing with problems of flight safety. Only then will we be able to establish an

automated information system which meets the present level of development of science and technology and which functions effectively for the purpose of improving quality of flight activities and flight safety.

New Teaching Method Tested at Air Force School

90R10008G Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 89 (signed to press 6 Oct 89) pp 14-15

[Article, published under the heading "Educator-Innovator's Rostrum," by Docents Candidates of Technical Sciences Cols V. Kudrinskiy and L. Fadeyev: "Learn Better, Teach Better"]

[Text] Today is a time of reexamination of old established or, more precisely, stale concepts and notions. For this reason we, who are teachers, would like to share our thoughts on the problems of education science in general and the military service school in particular.

Any important aspect of societal affairs should be examined against a social background. Many opinions on problems pertaining to education science are erroneous precisely because they focus solely on education science. It is declared to be virtually the root cause of all the ills of society. The greatest amount of criticism is leveled at those who teach: from elementary teachers to academicians. We feel that the cause-and-effect linkage has been turned around in such a view of things.

This fact indicates a need to analyze two points of contact between education science and practical affairs: motivation for learning, and favoritism. Its problems will be resolved when intelligence, competence, intellect, and talent become the main criteria in matters of moral and, most definitely, material incentive for each member of society. Education will begin to rely, one might say, on natural motivation: "I want to study! I want to live well! I want fully to utilize the results of technological advance, and since there is only one way to achieve this—my level of proficiency and the depth of my knowledge—I want to study." It is a sociopolitical task to create such an environment.

Only when the future specialist genuinely begins to perceive while still in school that his position in society is predetermined by the quantity and, most important, by the quality of his labor during his time of education, can the problems of education science be resolved. A society in which the younger generation is not imbued with this conviction will inevitably lose out in competition and will be left in the wake of history.

With the natural motivation of "I want" to counterbalance the currently-functioning "You must," everything falls into its right place. The student voluntarily approaches the teacher with questions which have arisen in the process of independent study. The teacher must possess a high level of competency and good methods proficiency in order to give intelligent, exhaustive answers. It is precisely this which determines whether he is suited to his profession. If the level of instruction is poor, the graduate will be rejected as deficient by the system of verification at the job to which he is assigned, with appropriate conclusions about those who taught him. Therefore the need for aggressive scholarly activity by the latter as well as individualized instruction is obvious.

A favorable situation has presently developed at military educational institutions of the Ministry of Defense, a situation which enables us to breathe life into the words "work with the individual student." This requires leaving the number of instructors unchanged while decreasing the number of students enrolled, and it requires introducing, finally, individualized instruction into the class schedule while not reducing the overall instructional load. A great deal has been said and written about individualized instruction, but it is not yet essentially being practiced.

Thus motivation to learn is determined by a social imperative to produce specialist personnel, an imperative which would lead to a shift from emphasis on today's coercive "you must" to the natural and solely productive "I want."

The practice of favoritism and special privilege is no less an evil. It is useless to combat it or, more precisely, it can even be dangerous. Favoritism, just as the fact of short-supply goods, comprises an integral part of and nutrient medium for the administrative-bureaucratic system.

A lack of objective information on an individual (obtained, for example, by testing) leads to persons being promoted on the basis of the conclusions contained in efficiency reports. These are written by one's superiors and are likely not to reflect a thorough description and evaluation of an individual's abilities and potential but rather a degree of liking or dislike toward the subordinate. This situation enables a bureaucrat to exercise absolute power in determining personnel matters.

Such a lip-service arrangement has also engendered an attitude toward the college diploma as being not a specialist-certifying document but rather an item in one's file which is needed for advancing up the career ladder. This in turn has adversely affected the education process which, as the students themselves aptly put it, is compared with standing in line for one's diploma. Denying the existence of favoritism in the military, and particularly at military educational institutions (from enrollment to duty assignment following graduation), means to close one's eyes to the truth. And this problem is taking on even greater acuteness in connection with reducing the number of persons accepted to enrollment. The number of persons benefiting from protection remains substantial, while there is a decrease in the number of persons entering school without outside help.

It seemed that the restructuring process which commenced in this country would within just a few years so

reform the socioeconomic structure of society that the need for highly-qualified specialists would finally become dominant. People were already figuring possible variations for reforming higher education. One can state on the basis of these last four and a half years, however, that except for some democratization within the higher educational institution, everything has remained the same as in the period of stagnation. It is apparently no easy matter to change a system which formed over the course of decades and which is fighting desperately for self-preservation.

We feel that the upsurge connected with new teaching methods, which embraced our elementary schools and spread to secondary schools and even higher educational institutions, is no mere accident. It was caused by at least two factors. First of all, there are a great many inquiring methods specialists in this country. Secondly, teachers adopted nontraditional teaching because they were tired of producing mediocre (defined as undereducated) graduates by taking guidance from instructions and procedures "cast in concrete."

There is no point in fooling ourselves about the scale of utilization of innovative methods. Their adoption disrupts the placid lives of the majority of teachers, and this is the reason for irritation with and even vicious attack on new innovations. This is quite understandable. And if conditions are not created for every teacher to gain the desire to teach better, innovators will remain few in number. The fact is that we are tired of hearing poor answers at examinations and observing intellectual inertia on the part of students in lecture classes and during practical class sessions.

Precisely for this reason the faculty in the department of theory of aircraft engines at the Kharkov Higher Military Aviation Engineering School conducted research on effectiveness of teaching the subject "Applied Thermodynamics and Heat Transfer." This study is making it possible to make adjustments in course curriculum, course topics and content of instruction classes, and to predict the quality of assimilation of specific items, topics, and the subject as a whole.

The results indicated that reserve potential for improving training and preparation of specialist personnel is largely exhausted with the framework of traditional teaching methods. Naturally the necessity arose to turn to the experience of educator-innovators. Study of the basic principles of the V. Shatalov method convinced them that there were no reasons why it should not be adopted at the school. Four principles were adopted: presentation of information in large blocks, multiple repetition of course material, mandatory feedback, and absence of conflict (see diagram).

They were implemented as follows. The material for each block was carefully selected and broken down into several parts (as a rule each part comprised a training topic items). The form of items presentation varied. In some cases it would be a combination of diagram and graph reflecting the physical essence of the process, and in other cases it would be an explanatory diagram and formula expression. Then this information would be placed on a basic instructional poster.

Meticulous selection of material for outline notes and compact form of presentation of material on the board made it possible to present a lecture at a rapid pace. As a result we saved one or two classroom hours on each topic, time which is used to reinforce knowledge. Thus multiple repetition of the fundamental points of covered material is predetermined by the structure of the lecture.

Feedback is accomplished in the course of mandatory brief drills and class discussions. Students would be selected in groups of from five to seven persons for checking quiz results. Four students would voluntarily join each selected student, resulting in five-man teams. Quizzes would be handled as follows. Following brief repeat presentation by the instructor of an already-covered topic, the instructional poster would be removed and problem variations displayed on TV screens. When the students were finished, the quiz sheets would be collected and handed to the student in charge of the five-man team to be checked. Grades are recorded in the grade book that same day.

The success of classes is determined in large measure by absence of conflict in relations between students and lecturer. We achieve such an atmosphere by ensuring an attitude of respect toward the students. Each successful performance is recorded, while grades of unsatisfactory are not given. Even in exceptional cases grades of unsatisfactory are not recorded in the grade book. Students are given the opportunity to make up for poor performance by the next class session.

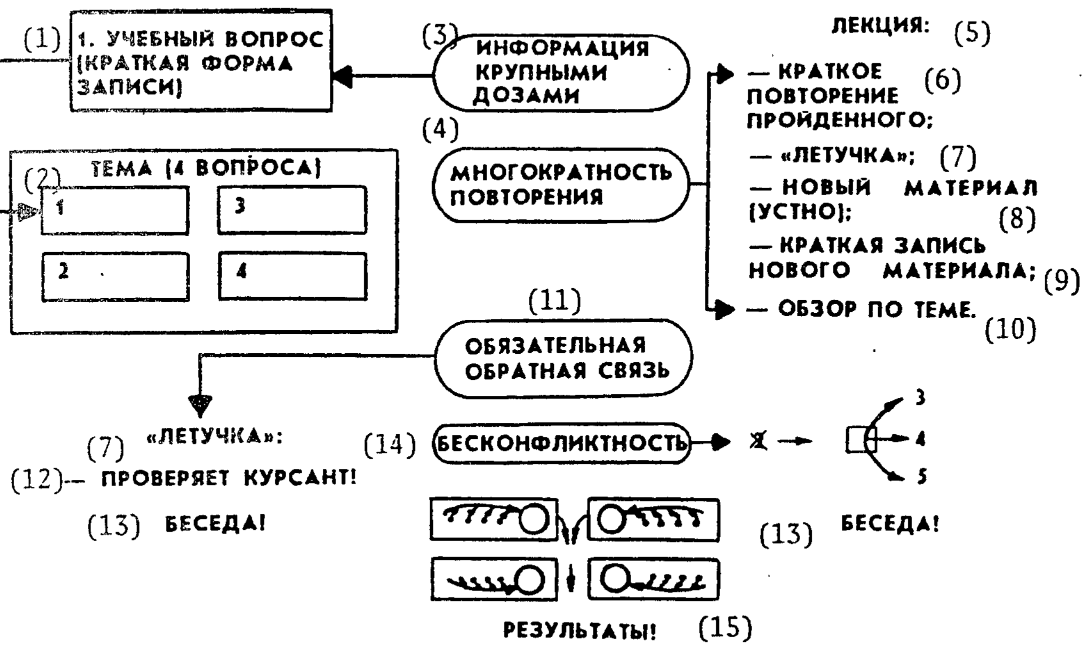
Consultations would be conducted utilizing all instructional posters in preparing for examinations. And results confirm the correctness of the chosen approach. There has not yet been a single failure to answer the questions on an examination card or a separate examination question. Some students displayed limited knowledge, but they did know something. Last year only five out of 200 persons in the experimental group received marks of unsatisfactory. They averaged a grade of 4.1 (the others averaged 3.92).

Three months after the examination the knowledge of both groups was tested. All of them were given the same questions. They were not informed of the test in advance. Those students who had been taught by the new method produced the same test results as on the examination, 4.1, while those who had been taught using the traditional method performed appreciably more poorly—3.69.

A questionnaire was filled out at this time by first-year and second-year students (approximately 500 persons). Almost 30 percent of the students in the experimental group stated that lectures had played the major part in their comprehension of the class material. Only 8 percent of the other students agreed. Typically the former,

Reference Signals Method

МЕТОД ОПОРНЫХ СИГНАЛОВ



Key:
1. Training item (concise form of notation)
2. Topic (four items)
3. Information in large doses
4. Multiple repetition
5. Lecture
6. Brief repetition of covered material
7. Short Quiz
8. New material (orally)
9. Brief notes on new material
10. Topic review
11. Mandatory feedback
12. Tests student
13. Classroom presentation
14. Absence of conflict
15. Results

with brief lecture notes, used their notes to a greater extent in preparing for the examination (75 percent as compared with 40 percent). In addition they spent less time preparing for lab classes (one hour and one hour and forty minutes respectively), which is evidently due to the thorough assimilation of the material as a result of multiple repetition.

Also interesting is how the students rated the instructor's professional and personal qualities. They value him first and foremost as a specialist.

Thus the results of studying the effectiveness of the new method of conducting lectures are promising and would suggest continuing to perfect this method. One should evaluate these results in a critical manner, however: first of all because the proposed method requires considerably more work than the traditional method, and secondly because there is always the possibility that the successful performance is highly noticeable against the background of general passivity on the part of the students. We would like to believe that similar structural reforms will take place in our society in the course of perestroyka, with conditions arising for intellectual awakening.

War Veteran Discusses High Wartime Aircraft Accident Figures

90R10008H Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 89 (signed to press 6 Oct 89) pp 16-17

[Article, published under the heading "Flight Safety: Experience, Analysis, Problems," by twice Hero of the Soviet Union Maj Gen Avn (Ret) G. Sivkov, candidate of technical sciences: "Could There Have Been Fewer Losses?"; concluding part of two-part article; part one appeared in the October 1989 issue of AVIATSIYA I KOSMONAVTIKA]

[Text] **Twice Hero of the Soviet Union Maj Gen Avn (Ret) G. Sivkov, candidate of technical sciences, reflects on aircraft accidents in conditions of combat operations)**

* * *

Mobilization of all the capabilities of the belligerents inalterably leads to a steep increase in intensity of flight operations. Statistics indicate that when shifting to

combat operations the average monthly flight time logged by aircrews increases by a factor of from four to five. There is a corresponding increase in psychophysiological stress on personnel. In addition to fatigue, this also engenders an acute shortage of time for mission-readying aircrews and aircraft, frequent disruptions of the work and rest regimen of engineer-technician personnel, as well as other negative factors. War is war....

The most important factor which appreciably affects flight safety, especially in the initial period of a war, is flight personnel neuroemotional stress. It is caused primarily by awareness of the fact that one's life is constantly at risk. Stress subsequently intensifies, particularly in connection with the receipt of information on heightened danger, such as information on the high degree of effectiveness of the enemy's air defense assets.

Neuroemotional stress, sometimes reaching a high level, leads to diminished quality of flying performance. This is particularly noticeable on takeoff and landing. I witnessed, for example, Sr Lt L. Kosov, in spite of the fact that he had successfully accomplished his mission, on three separate occasions smashing his airplane up when landing, while Sr Lt A. Martynov clipped off his landing gear while taking off in an Il-2, an exceptionally easy aircraft to fly. Misfortune also visited more experienced pilot Capt M. Tokar, when he found himself in a high-stress situation by running short of fuel on a training sortie, miscalculated his landing, and ran off the end of the runway. As a result the aircraft flipped over, killing the pilot.

Studies of the dynamic properties of the "pilot-aircraft" system and flying experience indicate that in some cases oscillatory instability of this system can occur—with the pilot involuntarily oscillating the aircraft.

In contrast to aircraft stability, stability of the "pilot-aircraft" system is determined not only by the properties of the aircraft, which change with flight configuration, but also by the characteristics of the pilot's actions, in particular by the so-called amplification factor K_a, which quantitatively characterizes his effect on the controls in response to aircraft departure from the desired parameters.

A certain critical value of this coefficient, $K_a=K_{acr}$, exists for each type of aircraft and specific flight conditions, with oscillation commencing when this value is exceeded. Amplification factor K_a increases sharply when there is heightened danger and when there is increased pilot neuroemotional stress, creating preconditions for the occurrence of oscillation. In particular, this would be observed during the initial period of flight training on a VTOL aircraft in takeoff and landing configurations.

Coefficient K_a increases when shifting to combat operations due to the fact that a real danger of being shot down arises. I know from my own experience how stress grabs a pilot from the moment he is given a combat mission, although he is not yet in any danger. What is happening? The received information mobilizes the combat pilot's inner reserves, as it were. It puts him in a state of tension. And if the "pilot-aircraft" system proves to be sensitive to an increase in K_a, the probability of oscillation can increase sharply. This must be considered in advance during preparation for flight operations, in order to ensure safety in actual combat.

For the sake of graphic clarity we shall present the difference between conditions of combat operations and peacetime training in the form of a summary comparative table.

The first thing one must do is gain a clear perception of the fundamental differences in conditions of combat operations and peacetime military flying (see Table). If pilots have no idea of an aircraft's behavior in the vicinity of critical configurations or of how to get out of a dangerous situation, but are compelled to fly in these configurations, an increase in aircraft accidents is inevitable.

No	Specific Features of Flight Conditions	Combat Operations	Peacetime Conditions
1	2	3	4
1.	Possibility of dying (death factors).	Death from enemy action. Probability of aircraft accident increased by a factor of 5-6.	No hostile action. Low probability of aircraft accident.
2.	Countering death factors.	Mobilization of all capabilities of personnel and equipment to achieve victory over the enemy. Drawing maximally close to critical flight configurations. Achievement of maximum possible flying precision in order not to go beyond the maximum point to critical configuration.	Absence of need to approach critical flight configurations and to achieve maximum flying precision. Establishment of maximum allowable values of flight parameters X_{all} less than X_{kr} by quantity X_{saf}. Severe penalty for exceeding established limits. To ensure against punishment—holding short of X_{all} by Delta X_{saf} and from X_{cr} by 2 Delta X_{sof}.
3.	Need for flight training in flight configurations close to critical.	Need for practical in-flight mastery of aircraft's behavior when approaching critical conditions and method of aircraft recovery from region of extreme configurations (principal preventive measure).	Prohibiting practical in-flight mastery of aircraft behavior when approaching critical flight configurations.

No	Specific Features of Flight Conditions	Combat Operations	Peacetime Conditions
1	2	3	4
4.	Required level of other types of flight training.	Vital necessity of high level of all other types of flight training in order to reduce probability of assignment and execution of missions beyond one's capabilities.	Deficient level of proficiency results in practically no increased danger. Assignment of tasks beyond one's ability is unlikely.
5.	Physiological stress load on flight personnel.	Increase in physiological stress load by factor of 4-5 over peacetime stress load.	Normal physiological stress load.
6.	Level of flight personnel neuroemotional stress.	Heightened stress due to awareness of possibility of being killed.	Normal stress.
7.	Stability of "pilot-aircraft" system.	Possibility of loss of stability of "pilot-aircraft" system for aircraft sensitive to increasing pilot actions amplification factor.	Stability of "pilot-aircraft" system is as a rule not disrupted (exception: with increased stress at initial period of learning to fly an aircraft or in an emergency situation caused by equipment failure).
8.	Objective purpose of flight and flight training as a whole.	Accomplishing the combat mission and remaining alive. Gaining the ability to perform combat missions in any and all conditions (in instrument meteorological conditions, at night, at extremely low level, at sea, in mountain terrain, etc).	Performing a combat training course maneuver sequence with a high mark, without an air mishap, and without exceeding operational limits. Completing the combat training plan and schedule. Attaining the scheduled level of proficiency.
9.	Time allocated for mission-readying flight personnel.	As a rule, sharply reduced.	More than adequate.
10.	Time allocated for flight-readying aircraft.	As a rule, acute shortage of time.	Adequate. Oversights and errors of omission in aircraft preparation due to the time factor are not permitted.
11.	Failure to observe work and rest regimen by engineer-technician personnel.	Frequent disturbances of work and rest regimen as a consequence of acute shortage of time.	As a rule there are no disturbances of work and rest regimen; such disruptions are punishable.
12.	Effect of climate and weather factors on engineer-technician personnel.	Heightened influence of climatic and weather factors when based at austere dirt strips and landing areas.	Limited effect of climatic and weather factors at permanent, well-equipped basing locations.
13.	Time allocated for performing specific measures pertaining to ensuring flight safety.	Sharply reduced due to overall acute time shortage.	More than sufficient. Oversights and errors of omission in conducting measures to ensure flight safety are not permitted, severely punished.

War experience indicates that the process of learning to fly in such configurations, and without proper training or preparation, is done in hasty fashion, at the cost of many lives, following the principle of "if you survive, you will master it." At the same time, in order to ensure flight safety, flying in these configurations cannot be mastered in peacetime.

What is the solution? It turns out that the conflict is in large measure resolvable.

What is needed for this? First of all, to prepare in advance for the conduct of supplementary flight training, which must be conducted rapidly and in an organized fashion in the initial period of combat operations (for the sake of brevity we shall call it "combat preventive measures"). Secondly, in peacetime one should organize measures to accomplish purposeful improvement in flight training, not involving increased risk.

The proposed preventive measures, aimed at preventing accidents during transition to combat operations, can be subdivided into two groups: advance measures, performed in peacetime, and combat preventive measures (final phase of training)—measures carried out in the initial period of a war.

Advance training can include training in special flight instructor courses involving critical configurations and high-precision flying (one instructor per unit); working up a concise program of dual flying with instructor for achieving practical mastery of configurations close to critical, methods of bringing aircraft out of the region of extreme configurations, and precision flying techniques (basic combat preventive measures, taking from 3 to 4 training flights); conduct of special drills on cockpit simulators, involving all pilots, promoting rapid, safe combat preventive measures. Future additions would include mastering approach to critical configurations and exit from the critical region on dynamic flight simulators.

I feel that it would be beneficial to examine the "pilot-aircraft" system in conditions of minimum stability factor with simulation of an increased pilot actions amplification factor K_a, corresponding to conditions of

heightened danger. Such studies should be conducted in two stages for each aircraft in service, as well as experimental aircraft and aircraft on the drawing boards: on a dynamic flight simulator and on a combat trainer (dual) in the air.

In case of detection of oscillation in a situation of heightened hazard, that is, when simulating an elevated K_a value, special exercises must be devised and conducted with all flight personnel, exercises focusing on method of ending oscillation ("anti-oscillation") on a flight simulator (for example, cutting in roll, yaw, or pitch damper, or increasing control stick loading). An appropriate in-air maneuver sequence should be devised and incorporated into the combat preventive measures program.

It is also important to complete additional engineering on control systems of aircraft sensitive to increased K_a (in a heightened-hazard situation), incorporating automatic oscillation correction into the process of manual control.

As we know, the level of pilot proficiency varies from one unit to another. Therefore for those who are insufficiently prepared for combat operations in various conditions (instrument meteorological conditions, night operations, flying at extremely low altitudes, in mountain terrain, etc) it is necessary to devise a special accelerated training program covering vitally important elements in dual-flight training with instructors (for brevity we shall call this training the "survival program"). Preventive measures of this type are also conducted within the framework of combat preventive measures, but on an individual basis, when needed by a specific pilot.

Combat preventive measures are performed without delay, from the moment of announcement of a high state of operational readiness, and include in-flight demonstration by instructor and performance by each pilot of approach to the most probable critical flight configurations and aircraft exit from the region of extreme flight configurations; increased flying precision (for example, execution of steep turns 10-15 meters above cloud tops), approach to onset of "pilot-aircraft" system instability (longitudinal oscillations, if this is possible on an aircraft of a given type in conditions of danger), with simulation of increased pilot actions amplification factor value at a safe altitude. In addition, it is necessary to arrange for carrying out individual programs for accelerated training of certain pilots in various complex flight conditions ("survival program").

In conclusion I should like to state the following. First of all, during preparation for and execution of the above-enumerated measures, it is essential to take into account the "effect of surprise," manifestation of elements of lack of proficiency. Let us assume that for an extended period of time everything has been proceeding satisfactorily in the unit: the training schedule is being met, the majority of pilots have earned the first-class proficiency rating, and there have been no air mishaps—in other words the level of combat pilot proficiency is fully in conformity with peacetime conditions. But with transition to combat operations, objective requirements on flight personnel training will also increase for this unit, which has become accustomed to considering itself highly-proficient, and the situation of a significant lack of pilot proficiency will arise quite unexpectedly. Psychologically this is difficult to accept, since everybody had been convinced of the opposite! But there are no objective reasons to doubt this situation, and one must be prepared in advance to overcome such a psychological obstacle. This requires first and foremost restructuring the conviction both of the collective and of the higher command echelon.

Secondly, the following question arises: why not incorporate into the combat training program maneuver sequences which help improve flying precision, and why not perform such maneuver sequences in peacetime? Such maneuvers require a high degree of neuroemotional concentration, however, mobilization of considerable volitional reserves, and without extreme need it may simply not be possible to accomplish them. In conditions of acute necessity, however, accomplishment of this task takes place much more easily and faster.

The above observations must be viewed only as a statement of the issue and as food for thought. Specific tasks pertaining to advance training and preparation for combat operations should be determined with careful analysis of the problems raised for each specialization area separately, tasks which must be innovatively accomplished today, as we are concerned with preventing a "surge" of aircraft accidents in case of war.

New Equipment in Aviation Medicine Reviewed

90R10008I Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 89 (signed to press 6 Oct 89) pp 18-19

[Article, published under the heading "Reader-Magazine-Reader," by Col V. Kuznetsov, candidate of biological sciences: "The Resources of Aviation Medicine"]

[Text] **"Increasingly higher demands are being placed on us aviation medical people as regards quality of work performed and keeping Air Force personnel in good health. Unfortunately, however, these demands are not reinforced by improving our working conditions and capabilities. In particular, we need substantial improvement in the technical equipping of our medical facilities. I would like to know what is being done in this area," writes Capt Med Serv O. Kharkov.**

At the request of the editors, Candidate of Biological Sciences Col V. Kuznetsov replies to our reader.

* * *

Military aviators today face heavy work and stress loads, with the highly-complex aircraft in operational service. There has correspondingly been an increase in the demands on aviation medicine as regards diversified technical means of supporting flight personnel training and monitoring their state of health. Up to the present time a technocratic principle of design and construction has dominated aircraft engineering, which gives very little consideration to the capabilities of the human element in the "man-machine" system. Negative consequences of this include increased psychoemotional stress, rapid exhaustion of one's physiological reserves, and diminished working efficiency and fitness, leading to physical ailments, early loss of ability to perform one's duties, and grounding from flight operations.

Practical realities urgently demand that we address man and concerns about man. Providing favorable conditions for the human operator is a most important task in designing and building new equipment. While in the past development organizations expended considerable funds on designing and developing new arms and equipment, leaving nothing for systems for training the human operator who was to operate and control this hardware, today society finally realizes the pernicious nature of such a policy. Proportional economic outlays are needed, both on hardware proper and on means of life support for and protection of crews while aloft, their ground training, as well as measures aimed at developing ecologically and environmentally safe equipment.

This was fostered in large measure by adoption of the CPSU Central Committee and USSR Council of Ministers decree entitled "Basic Directions of Development of Public Health Protection and Restructuring of USSR Health Care in the 12th Five-Year Plan and the Period Up to the Year 2000," implementation across the board of the "Zdorovye" [Health] program, and the firm position taken by Air Force aerospace medicine officials in matters pertaining to medical and social protection of flight and engineer-technician personnel.

Medical equipment of new types has recently been installed at Air Force production enterprises, promoting and fostering the accomplishment of a number of important tasks. Initial equipment has also begun to be delivered to air units.

The former technical arsenal of aviation medicine is taking on a new quality. Equipping altitude chambers, centrifuges, impact and rotation test benches with automated control systems makes it possible to program and obtain the required conditions affecting the pilot. A combination of basic operating factors with supplementary factors (temperature, illumination, physical stress load, elements of activity) will make it possible to approach actual flight conditions. Increased effectiveness of tests conducted on this test equipment is also anticipated with the employment of new diagnostic equipment and computer hardware.

Experimental models of small-size equipment have already been obtained, providing capability to evaluate the state and condition of a human subject both in the course of ground tests and in actual flight conditions (Talisman, Orion, AFI-R). Each such system records in an expanded or reduced variation cardiovascular and respiratory system indices, biopotentials of skeletal and eye muscles, body temperature and other parameters. The new equipment offers enhanced immunity to interference through use of analog-to-digital conversion and optimal filtration of interference and artifacts. This makes it possible to study airmen not only in a state of rest but during work as well. As a rule these data are recorded by Tester or Gamma onboard data recorders with subsequent automatic data interpretation.

In newly-developed equipment (Orion) the designers have applied the modular principle in designing the airborne component, which enables the medical worker, depending on the purposes of the study (evaluation of fatigue, state of the central nervous system, medical monitoring, etc), to select a number of channels from a large number of instrument capabilities.

The PAV-02 flight surgeon's instrument will constitute the next stage of development of the regular-production Fiziolog and PAV-01 units, used to monitor the functional state of pilots during preflight and post-flight examinations. The PAV-02 contains many of the airborne equipment channels and, in addition, contains a psychophysiological indices unit, which measures muscular exertion, short-term memory, and the critical frequency of light flashes.

The physiological apparatus used in aviation naturally differs from the devices of clinical medicine. A more precise diagnosis is essential here in determining a premorbid state, as well as in evaluating degree of fatigue and diminished efficiency and work fitness. A large number of various medical indicators are needed in order to obtain data on each subject, as well as comparison of these indicators with the individual norm and the psychological and emotional state preceding a flying work load.

Certain hopes in this area are placed on extensive utilization of computers. It is not mere happenstance that more and more devices are equipped with computer communication interfaces. The principal functions of the computer consist in collecting information from various measurement channels, arranging this information into a computer file for the subject individual, logical processing of data, calculation of combined parameters, printout of results, and storage of data on floppy disks. A medium-speed microcomputer with from 64 to 128 kilobytes of RAM (SM-1800, Elektronika-60, Robotron-1715, etc) is adequate to perform these functions.

More powerful computer systems (SM-1420), with considerable external storage capability, are used when there is a need for expert decision-making and creation of an

archive for a specific group of subjects. With centralized data banks and computer networks it is possible quickly and efficiently to evaluate the functional state and task readiness both of individual pilots and of air subunits and to devise long-term programs for restoring physical energy and health as a whole. Such systems will soon be in use in line units.

Appreciable changes have occurred in the technical equipping of general outpatient clinics and military hospitals. Utilization of the latest equipment is becoming a decisive factor in improving medical care and improving the quality of diagnosis and effectiveness of medical treatment of Air Force personnel.

Medical equipment is presently being used (or will be delivered in the near future) at Air Force medical facilities. This equipment includes fiber-optic flexible endoscopes, EKG machines and spirometers with built-in processors and automatic EKG and respiration analyzers, imaging infrared scanners, ultrasound echolocation units, etc.

X-ray equipment is being supplanted by NMR tomographs. High-speed analyzers, automatic dosing units, and sets of reagents, including for rapid analysis, have joined the arsenal of laboratory equipment. In coming months Ministry of Medical and Biological Industry plants will commence mass production of disposable syringes. Modern medicine employs a broad spectrum of physical effects for therapeutic purposes: electromagnetic fields, optical, laser, ultrasound, and ionizing radiation, hyperthermia, cryogenics, etc. Medical science is utilizing both ancient treatment methods and the latest advances in the natural sciences.

Some individuals, paying increasing heed to their own health, are practicing self-healing, and in many instances are fabricating individual devices for preventing fatigue, removing pain syndromes by acting on biologically active points, are employing magnetotherapy and other forms of active treatment. Obviously all this should be directed to man's benefit. Needed on the one hand is the flight surgeon's oversight and, on the other hand, the availability of reliable commercially-manufactured diagnostic and prophylactic devices.

Today there is heightened interest in portable blood pressure measuring devices and cardiac warning devices, which beep if the pulse rate exceeds a specified level. There is a need for household radiation counters and noise level measuring devices. We are waiting impatiently for industry to provide us with small electrostimulation devices, acupuncture devices, individual inhalers, and vibration massage units.

Training devices promoting physical development and specific fitness play a special role in pilot training. The most sophisticated device of this type at the present time is the Statoergometr.

Even a brief survey of the technical devices employed in aviation medicine shows that they comprise a broad category of equipment. Who is to operate and maintain them? Some higher educational institutions in this country (Moscow Higher Technical School, Leningrad Electrical Engineering Institute, etc) are already training specialists in medical equipment, but there are very few such individuals in military aviation. We need well-trained engineers.

Argument for Banning Tactical Nuclear Weapons in Europe

90R10008J Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 89 (signed to press 6 Oct 89) pp 34-35

[Article, published under the heading "Today's World and the New Thinking," by Col S. Zenin, candidate of historical sciences; Professor I. Panshin, doctor of technical sciences; engineer L. Chernousko: "Does Europe Need a Nuclear Club?"]

[Text] The saying "Everything flows, everything changes" is entirely appropriate to military affairs. Take tactical weapons, for example. All kinds of systems have fallen within this category! But what is happening today?

In diplomatic and military practice, the following are generally considered tactical nuclear weapons: tactical missiles (range capability to 500 km), artillery systems (to 50-60 km), and tactical strike aircraft (to 1,000 km or more).

This triad constitutes a specific-purpose integrated combat system. The ratio of tactical nuclear weapons in Europe (Warsaw Pact and NATO) is as follows: 12 [sic] to 1 in missiles; 1 to 1 in artillery; 1 to 1.5 in aircraft. The Warsaw Pact possesses superiority in missiles, and NATO in aircraft, but it is believed that an approximate balance exists between the two military-political alliances when one considers the aggregate nuclear power of the two sides and the performance characteristics of the force components.

If this is the case, and one is concerned with strengthening security and stability in Europe, why not hold talks on reducing nuclear weapons on a bilateral basis, followed by talks on the total elimination of nuclear weapons? Consider the positive example of the Soviet-U.S. INF Treaty. After all, these missiles represented a considerable threat to peace in Europe and to world peace as a whole. Reason and the principle of the new political thinking emerged victorious at these talks, and on 26 July of this year TASS reported completion by the Soviet side of elimination of OTR-22 shorter-range missiles. This is now the second completely-eliminated category of missile. The first to be eliminated—intermediate-range ground-launched cruise missiles—were eliminated in the USSR in the fall of last year.

It is impossible, however, to achieve final elimination of the danger of sneak attack while maintaining nuclear

weapons in Europe, for these weapons possess enormous destructive potential and could trigger a worldwide thermonuclear catastrophe.

If nuclear weapons were employed in Europe, states a declaration by the Warsaw Pact member countries, this continent would be turned into a radioactive desert. The storage, modernization and, in particular, further buildup of tactical nuclear weapons would exert an increasingly destabilizing influence on the military-strategic situation in Europe and would be incompatible with efforts directed toward resolving the problems of disarmament in Europe.

Addressing the NATO alliance, the Warsaw Pact expressed its conviction that, in addition to elimination of intermediate-range and shorter-range missiles, positive resolution of the matter of the above-mentioned tactical weapons would be in conformity with the idea of nuclear disarmament, confidence building, and normalization of the situation in Europe. A specific conversation on this topic was held during a discussion between M.S. Gorbachev and U.S. Secretary of State James Baker in May of this year. We proposed to the Americans that they join us in drawing up a bilateral agreement on verifiable cessation of manufacture of all fissionable materials for weapons of mass destruction, as well as discussing the elimination of tactical nuclear weapons. But shortly thereafter the U.S. Secretary of State declared that the Soviet proposal to commence talks on these weapons was "propaganda"....

The argument is that these missiles, artillery shells and bombs are tactical and constitute battlefield weapons, and therefore are of limited effect and application. Therefore, according to the logic of the NATO politicians and generals, there is no particular reason to be concerned about them or to protest their existence. It is not mere happenstance that NATO officials are persistently seeking ways and devising methods aimed at making use of these weapons acceptable under certain conditions. Possible variations are rehearsed at exercises ("Autumn Forge," "Team Spirit," etc,), which have assumed such a large scale that one would think the world were standing at the brink of war.

It is quite obvious that modern tactical nuclear weapons are a qualitatively new type of weapon. Missiles of this category have a range capability of up to 500 km. And what about aircraft? Fixed-wing tactical strike aircraft and combat helicopters represent for all practical purposes the most sophisticated type of offensive arms. Strike aircraft systems are substantially superior to tanks and artillery in fire capabilities. Experts have calculated that if the firepower of an artillery system in terms of capability to destroy targets is assigned a value of 1, a tank exceeds it by a factor of 3-4, a combat helicopter by a factor of 5-7, and a strike aircraft by a factor of 10-12. In addition, depth of strike exceeds 1,000 kilometers for fixed-wing aircraft and is up to 250 kilometers for helicopters.

In spite of the currently fairly high level of tactical nuclear weapons, the United States is considering a substantial upgrade of these weapons, further increasing their combat capabilities. Behind this one can see an attempt at up-arming of NATO forces in Europe, as well as an attempt to compensate for the eliminated intermediate-range and shorter-range missiles. Just what specifically are the U.S. intentions?

There are plans to upgrade the Lance missile, which has a range of 130 km, boosting range to 500 km, as well as to develop a new air-to-surface nuclear missile with a range capability in excess of 400 km, to be carried by tactical strike aircraft, as well as upgrading of the SRAM air-to-ground missile, which will significantly increase an aircraft's combat delivery radius without coming into effective range of enemy air defense. It is reported in the foreign press that, beginning in 1995, U.S. strike aircraft as well as Tornado fighter-bombers will carry this missile. Proposals include retargeting approximately 100 sea-launched Tomahawk missiles to support the NATO mission in Europe, to complete this year replacement of nuclear rounds for the 203.2 mm howitzers, and to commence in 1990 manufacture of nuclear rounds for 155 mm howitzers. And that is not all. An additional approximately 50 new nuclear-weapon-carrying strike aircraft (apparently the FB-111A) are joining the more than 140 F-111 fighter-bombers already deployed in the British Isles.

This U.S. policy is aimed at initiating a new round in the arms race and is leading to a tipping of the military strategic balance in Europe. The planned up-arming is simply incompatible with noted positive trends in international relations. Pursuant to the INF Treaty, for example, the Soviet Union is totally eliminating OTR-22 missiles with a range capability of up to 1,000 km and the OTR-23 with a range capability of up 500 km. Violating the spirit of the INF Treaty, the Pentagon came up with a scheme to develop, we emphasize, the Lance 2 tactical missile, with a range capability of 500 km. The urgency of this problem also lies in the fact that tactical nuclear weapons, by virtue of their specific features, are the least verifiable. Even to a greater extent than strategic weapons, they can become the cause of an unsanctioned nuclear conflict.

The entire world welcomed the bold step taken by the Soviet Union toward unilateral reduction of its military forces and arms. The scale of these reductions is truly impressive: 500,000 military personnel, 10,000 tanks, 8,500 artillery systems, and 800 combat aircraft. But not everybody knows that, together with the troops being withdrawn, at the same time we are removing tactical nuclear weapons from the territory of allied European countries, including air-launched, nuclear artillery, and tactical nuclear missiles.

In addition, the Soviet Union is prepared, as stated by M. S. Gorbachev, to remove all nuclear munitions from the territory of its allies between 1989 and 1991 under the condition that the United States undertakes an

analogous response step. The times urgently demand that talks be commenced on the entire spectrum of tactical nuclear weapons, not reducing everything merely to missiles, as Washington is attempting to do. It is essential to reach, in mutual agreement, a reasonable solution in the spirit of the new thinking.

Mankind is also waiting for a decision on a 50 percent reduction of intercontinental ballistic missiles, signing of a treaty on military forces and arms in Europe, and the signing of a chemical weapons convention. But it would appear that the White House is in no hurry to resolve these urgent problems. On the contrary, development of the "Star Wars" program and development of new weapons of mass destruction which are by no means defensive in nature is stubbornly continuing across the Atlantic. All this is incompatible with the aspiration of peoples to live in peace and security and with their demands to bring an end to the arms race and to shift a substantial portion of military expenditures over to social needs.

Regarding the "triad," we should mention important proposals advanced at various times by the USSR and the Warsaw Pact pertaining to this triad, including a proposal to reduce the forces of the two parties so that they lose their offensive potential, a proposal to create a nuclear-free corridor along the line of contact between the Warsaw Pact and NATO, and a zone of reduced concentration of arms on the European continent. It is essential to adopt a system of advance notification not only of ICBM and SLBM launches but also of the mass launching of strategic and tactical aircraft. This latter measure is especially important, since all wars in recent decades began precisely with a massive air attack.

One such proposal was recently implemented—in June of this year the USSR and the United States signed an agreement on preventing dangerous military activities. It prescribes specific steps to prevent incidents between the military forces of the parties and to settle such incidents by peaceful means. Toward this end a procedure has been drafted for establishing and maintaining communications between commanders of forces and fleets as well as between commanders of warships, aircraft commanders and shore. This agreement became possible thanks to development of political dialogue between Soviet and U.S. leaders, maintaining military contacts, as well as good will on the part of both parties. This document is fully in conformity with the political and defense interests of the Soviet Union. It serves as one more evidence of implementation of a defensive military doctrine aimed at preventing war.

On the eve of the May meeting of the NATO Council in Brussels, sharp debates flared up in NATO circles over U.S. plans for further militarization of Western Europe, and in particular the U.S. intention to develop and deploy Lance 2 short-range nuclear missile units primarily in West Germany. But the FRG, joined by Belgium, Denmark, Spain, Greece, Italy, and Norway, spoke out in opposition to an immediate decision to upgrade and expressed their support for conducting talks with the Warsaw Pact. Something of a compromise was reached as a result of heated debate at the meeting. The United States was compelled to give up its dangerous scheme and postpone a decision on missiles until 1992.

The Americans were forced to consent to enter talks with the Soviet Union and the Warsaw Pact on tactical nuclear weapons, but with the proviso that such talks could commence only after an agreement on conventional forces was reached in Vienna and even after commencement of its practical implementation, that is, once again conditions, stipulations, and attempts to stall. In addition, we do not know whether our Western negotiation partners in Vienna will once again hit hard on the brakes, avoiding specific, constructive steps.

At the above-mentioned NATO Council meeting President Bush announced a certain reduction of U.S. military forces and conventional arms in Europe, but failed to give specific figures. We believe that this statement by the President can be taken as a response to recent initiatives by the USSR and the WTO. The declaration adopted at the meeting also takes note of an endeavor to bring an end to the "splitting of Europe" and to achieve a "firm and just peace." And yet the document evokes mixed feelings, because alongside constructive points it still contains elements of "theory of nuclear deterrence" and a policy of force, as if nothing has changed in the world in recent years.

We can cite the following supporting facts. Washington declared its willingness to proceed with reduction of air forces, but exempting, we might note, tactical strike aircraft, which form part of the "triad" discussed above. At the present time the members of NATO are also rejecting total elimination of nuclear weapons in Europe.

Principles of Soviet foreign policy for coming years were proclaimed at the USSR Congress of People's Deputies. Permeated with the new political thinking, these principles presuppose in particular the elimination of nuclear weapons, reduction of the defense potential of states to levels of reasonable sufficiency, rejection of the use of force or threat of force in relations between countries, as well as other constructive measures.

The idea stated at the Congress pertaining to guaranteeing a country's security primarily by political and diplomatic means is persuasively confirmed by the results of the official visit to the FRG by CPSU Central Committee General Secretary M. S. Gorbachev, chairman of the USSR Supreme Soviet. A joint statement signed in Bonn reflects the desire by both states to proceed along the path of building a peaceful common European home, a resolve to prevent any war, both nuclear and conventional, to eliminate weapons of mass destruction, and to induce the interested parties to begin talks on tactical nuclear weapons. "War should no longer be an instrument of politics," the Joint Declaration states. "Politics in matters of security and armed forces organizational development should serve solely to

reduce the threat of war and to guarantee the peace with a small quantity of weapons. This eliminates the possibility of an arms race."

Improvement of Soviet-American relations, the signing and implementation of the INF Treaty are exerting a positive influence on warming up the international climate. This attests once again to the fact that a great deal can be achieved through the united efforts of countries and peoples. After all, our countries witnessed the notable historic fact of alliance between states with a differing social system—the anti-Hitler coalition during World War II, consisting of the USSR, the United States, and Great Britain. In the face of fascist aggression and the pretensions of Hitlerite Germany to world domination, they made common cause against a common foe and emerged victorious.

Today as well we all have a common enemy—the threat of nuclear self-destruction. Aware of this fact, the Soviet Union pledged never to be the first to use nuclear weapons and not to initiate military operations against any other country unless the Soviet Union were the target of aggression. Other states can and should adopt such decisions.

Our planet's environment is deteriorating year by year. This dangerous trend can be stopped and the environment for man's habitation can be improved only through unified efforts. There are examples of good international cooperation in the areas of the economy, medicine, scientific research, and sports. The possibilities and prospects of effective joint actions by countries and peoples are great indeed. But we feel that the most important cooperation is in preventing a thermonuclear catastrophe and curbing the arms race, including banning the upgrading and stockpiling of tactical and other nuclear weapons of mass destruction, for which all mankind and each of us has absolutely no use. It is high time to put an end to the dangerous "triad" in Europe!

Igor Sikorsky Lauded as Pioneer Russian Aircraft Designer

90R10008K Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 89 (signed to press 6 Oct 89) pp 36-38

[Article, published under the heading "Pages From History," by Col V. Doroshkov, candidate of technical sciences: "Creator of the 'Russkiy Vityaz'"]

[Text] **Having acknowledged the primacy of values common to all mankind, today we are beginning to return to the pantheon of Russian fame the names of those who are entitled to an honorable place therein—our great fellow countrymen who lived and worked abroad and who made a major contribution to the development of world culture, science and technology. These persons include eminent aircraft designer Igor Sikorsky.**

* * *

Prerevolutionary Russia was proud of this man. Postrevolutionary Russia preferred to forget about him. His name was rarely mentioned, and for the most part was not mentioned at all. In books published at the beginning of the 1950's one finds photographs of heavy aircraft which were amazing for their time: the Sikorsky "Russkiy Vityaz" [Russian Hero] and "Ilya Muromets," but not a word about the man who designed them. The fact is that this aircraft designer emigrated abroad in 1918. This was enough to delete his name from the history of Russian aviation for many decades.

Igor Ivanovich Sikorsky was born in Kiev, to the family of a prominent psychiatrist. From early childhood he was attracted by the idea of flight by man. After graduating from naval cadet school in Saint Petersburg, he studied at technical school in Paris, and in 1907 he returned to Russia and enrolled at Kiev Polytechnic Institute, from which he graduated. This lad was captivated by the idea of designing flying machines; it was to become his life's passion.

Even if Sikorsky had not designed any more aircraft after leaving Russia, nonetheless he would have remained a great aeronautical engineer in the memory of Russians and of the entire world. He is credited with designing 27 types of aircraft built in Russia, including the famed "Ilya Muromets," the world's first aircraft powered by more than two engines, which people believed could not be done.

In July 1909 he commenced full-scale testing of Russia's first helicopter. The rotors developed insufficient lift, however, and the following year he came out with a new design. This time—once again for the first time in Russia—the craft was able to lift its own weight. Nevertheless the designer concluded that the age of helicopters had not yet arrived. He directed all his energies toward designing fixed-wing aircraft. Igor Ivanovich built and personally flight-tested in Kiev six airplanes, which received a number of coveted awards in competitions involving the participation of foreign models.

From the very beginning Sikorsky's designs were distinguished by uniqueness and originality, and the S-6 aircraft brought him national fame. Possessing good aerodynamic characteristics, it set what was a speed record for that time. This was the first Russian aircraft to demonstrate superiority over foreign aircraft and to be adopted by the military.

In April 1912 Sikorsky, still a student, was offered the position of chief designer in the aircraft department of the Russian-Baltic Railcar Plant. Several aircraft were built at this plant under Sikorsky's direction. One of them, the S-6B, won first place in a military competition in September 1912, beating the best foreign entries.

The S-7, on which the designer tested a monoplane arrangement, was the first Russian aircraft to be sold abroad. In 1916 he built the S-19—one of the world's first ground-attack aircraft.

Sikorsky felt that increasing aircraft speed and load-carrying capacity was a promising direction in the development of aviation. He embodied the former in the S-9 three-place monoplane, which featured aerodynamic fairings and a monocoque fuselage. The designer felt that achieving the latter objective would involve designing and building large, heavy, powerful aircraft powered by several engines. He felt that our country, with its vast distances, lack of roads, and adverse climatic conditions, needed precisely such aircraft. In his opinion these giant aircraft would be more reliable and would be indispensable in passenger service, in hauling urgently-needed cargo, and in the development of Siberia, including organization of a network of "aviation stations."

The world's first heavy aircraft, which he designed—the "Russkiy Vityaz" and the "Ilya Muromets"—were the prototype for future long-range bombers and for modern airliners.

A full-scale model of the four-engined aircraft "Ilya Muromets" is presently on display at the aviation museum in Monino. Its maiden flight took place in December 1913. It was a genuine triumph of Russian aviation: an unprecedented record-setting aircraft had been built in technically-backward Russia. It featured a comfortable, heated passenger cabin with electric lighting, a sleeping accommodations cabin, and a toilet. It was unequaled in payload capacity and range. The aircraft weighed 3,500 kilograms minus payload, and it could carry a payload of 1,500 kilograms. The aircraft reached speeds of 90-100 km/h in flight tests.

On one of its flights, carrying 10 passengers, it reached an altitude of 2,000 meters. This was recorded as a world altitude record with passengers. Soon thereafter the "Ilya Muromets," carrying six passengers, remained aloft 6 hours and 33 minutes. This was another major victory for Russian aviation.

In the summer of 1914 this giant aircraft made its famous flight from Saint Petersburg to Kiev. It flew the 700 versts nonstop from the capital to Orsha in 8 hours. The aircraft made the return trip from Kiev to Saint Petersburg in 13 hours, a world record at the time.

This airplane's numerous successes drew the attention of the War Ministry. Typically the "Ilya Muromets" was viewed at first not as a bomber but as a unique means of long-range reconnaissance.

Thanks to Sikorsky and others of like mind, at the beginning of World War I the Russian Army was the only army to possess a heavy bomber and long-range reconnaissance aircraft. The initial, uncoordinated and isolated employment of these giant aircraft on the battlefronts, however, was unsuccessful. A squadron of aircraft was formed to demonstrate their effectiveness—the world's first strategic aviation unit. The regular production in quantity of heavy multiengine aircraft, also a world first, was set up through the efforts of Igor Sikorsky and his associate M. Shidlovskiy. Development of the "Muromtsy" fostered the appearance of totally new branches of Russian aircraft industry—engine building, instrument engineering, aircraft armament, and others.

This was a busy time in the life of this aircraft designer. Sikorsky flew a great deal—giving dual instruction to military pilots, testing newly-arrived or repaired aircraft, and solving numerous problems connected with special equipment and armament and installing it on the aircraft. At that time he was probably the only designer in the world who spent a large part of his time not in the design office but at the front, in the very thick of things. Here Igor Ivanovich obtained information firsthand on the handling and behavior of his offspring in a combat environment. This made it possible not only quickly to effect needed design changes in order to increase the efficiency and effectiveness of these giant aircraft but also to develop their combat tactics.

The team headed by Sikorsky, in addition to design, development and building of bombers and reconnaissance aircraft, provided the Russian Army with various types of fighters: a multiseater, twin-engine escort, a single-seat and two-seater single-engine interceptors.

They also worked on problems pertaining to using heavy aircraft for assault operations.

Sikorsky was one of the first to grasp the importance of the concept of specialization—using fighters, interceptors, short-range and long-range reconnaissance aircraft, light, medium, and heavy bombers in place of light multirole aircraft. Development of these groups of combat aircraft, which represented all basic types at that time and into the near future, was unfortunately limited by lack of an adequate quantity of aircraft engines and little production capacity. Nevertheless Sikorsky's design office was keeping pace with the times, and in many cases was even ahead of its time. The accomplishments of this team brought deserved fame to the young Russian aircraft industry, showing the entire world that in this once-backward country there was taking place a process of forming of powerful industry, the development of scientific and technical personnel capable of producing aircraft which were quite advanced for the time.

An abrupt change in direction in this aircraft designer's life occurred in 1918. His contract with the Russian Baltic Plant ran out. It is said that not long before his departure with a group of aircraft engineering experts, Sikorsky paid a visit to Yu. Larin, father of Bukharin's wife (at that time Larin was a member of the Collegium of the Supreme Council of the National Economy). This novice economic administrator saw aircraft plants as being no different from factories making perfume and

pomade and submitted a proposal to close them down and convert them to furniture manufacture.

This unquestionably made a staggering impression on a person dedicated to a sole idea—building airplanes. Soon the factory-plant committee gave Sikorsky permission to travel to France to work on a French version of the "Ilya Muromets." He sailed from Murmansk in March 1918, never dreaming that he was leaving Russia forever. Thus began a new life on foreign soil, a life filled with trials and tribulations.

World War I came to an end. France no longer needed the bomber for which it had earlier placed an order. Nobody wanted anything to do with this emigre designer. But back in Russia the Civil War had already begun. Sikorsky decided to move to the United States. He set foot in the New World on 30 March 1919.

Igor Ivanovich felt that in the United States, just as in Russia, there was a great need for heavy aircraft, and therefore he would not be without work. His hopes of working in his beloved field, however, did not materialize. The moment had not yet come for taking aviation to the vast regions of the United States.

In the United States as well, the aircraft industry cut back enormously after the war; airplanes and aircraft engines were sold at cut-rate prices. Unemployment rose appreciably. There was virtually no possibility of obtaining any work in aviation, let alone designing aircraft. The following years were very difficult for Sikorsky—without money and without work. But he refused to give up his dream: to design and build multiengine cargo and passenger aircraft capable of carrying from 40 to 50 passengers.

The designer did not lose hopes of returning to aviation, and he worked on the design of such an aircraft. A small group of Russian emigre enthusiasts gradually formed around him; they decided to challenge the big aircraft companies. The group had no money, no source of financing, and no production facilities, but they had enthusiasm and profound faith in their "chief designer."

In March 1923 a company was born, with the high-flown name Sikorsky Aero Engineering Corporation, with total capitalization of 800 dollars. They were hoping to obtain the bulk of their capital requirements by selling stock. In view of the high risk of the enterprise as well as the market of potential shareholders, shares were sold at 10 dollars each. To the skeptics' amazement, the ranks of shareholders grew rapidly. For the most part they were Russian emigres. Blue-collar workers, engineers, and former military officers endeavored to make whatever contribution they could toward the creation of a "Russian" company with a Russian president.

Early that spring Sikorsky and several dozen volunteers began working on a farm belonging to a Russian emigre near New York City. Their equipment was very primitive. They were short of materials. They themselves made everything that could be fashioned by hand. They gathered parts at junkyards and purchased military surplus items at war surplus sales. Because of this, Sikorsky was constantly forced to adjust the design, to accommodate the materials they were using. In spite of the difficulties, however, they were able to build a solid, elegant aircraft.

The S-29A (Sikorsky-29, A—American), a further evolution of the "Ilya Muromets," was completed by the summer of 1924. The airplane made quite an impression: duralumin wings and fuselage, an impressive biplane structure, and massive landing gear. The passenger cabin, which could be quickly converted into a cargo hold, was centered on the wing, while the open pilot cockpit was positioned aft, toward the tail.

The airplane had a cruising speed of 160 km/h, a top speed of 185 km/h, and was designed to carry 14 passengers.

The United States was literally staggered by the S-29A. The first commercial haul, two grand pianos transported from Roosevelt Field to Washington, was an excellent advertisement of the plane's reliability, payload capacity and cargo hold spaciousness. The aircraft's designer personally flew his aircraft all over the country, earning money for designing and building future aircraft.

At the end of the 1920's the Sikorsky Corporation built several aircraft of various types. The passenger aircraft were the most successful. But there was one common feature: most of the airplanes had civil but not military application. The designer felt that the airplane's principal mission was to make life easier for people.

Sikorsky's passenger aircraft linked continents for the first time. Flying boats and amphibious aircraft became particularly popular, having achieved a number of world records in load capacity, speed, altitude, and distance.

Things were frequently difficult for Sikorsky. Sometimes things seemed almost hopeless. The trimotor S-35, with which French pilot Rene Fonck was intending to make the first nonstop intercontinental flight, ran out of runway while trying to take off. The aircraft was wrecked. With it went almost the company's entire future: the S-35 was not insured.

Alien skies would test this aircraft designer repeatedly for strength and firmness of spirit and for dedication to his dream. And he withstood all trials. Talent, multiplied by incredible diligence, purposefulness and stick-to-itiveness made Sikorsky one of the leading aircraft designers in America and the entire world.

There was another, third page in the amazing biography of this outstanding individual—he became an acknowledged world authority in a fundamentally new area of aviation—helicopter engineering. Igor Ivanovich never gave up the idea of returning to his first love—helicopters.

At that time people had a fairly skeptical attitude toward these aircraft. There were few who believed in the

possibility of their practical application. Using a single-rotor design, which had first been developed in Russia, Sikorsky built the first practical helicopter of this classic design, in spite of lack of understanding, limited resources, and initially meager facilities. At the end of the 1930's and beginning of the 1940's, a team working under his guidance worked out the basics of designing and building helicopters in quantity and solved the basic problems pertaining to helicopter aerodynamics and structural strength. For the first time anywhere in the world regular production in quantity was set up for helicopters of the most diverse types—civilian and military, light helicopters and superheavy "flying cranes."

Rotary-wing aircraft bearing the letter S contributed to the defeat of Hitlerite Germany and militarist Japan. They evacuated wounded and were used for liaison, reconnaissance, and artillery spotting. Enemy pilots were tasked with hunting down Sikorsky's "whirlybirds." They proved to be not so easy to shoot down, however. The low altitude at which they flew (at treetop level) made helicopters difficult to spot. And if a fighter did spot a target and head for it, the helicopter pilot, utilizing his aircraft's high degree of maneuverability, would nimbly avoid the enemy's fire. The fighter would overshoot its target. It proved to be much more difficult to shoot down a slow-flying, defenseless helicopter than a high-speed target.

The success of Sikorsky's helicopters stimulated development of this branch of aviation in other countries. Manufacture of helicopters commenced under Sikorsky license in the leading countries of Western Europe. This aircraft designer remained true to his dream right up to the last years of his life (Igor Sikorsky died on 26 October 1972).

Helicopters of his design embodied the concepts of the crane-helicopter and amphibious helicopter, accomplished the first intercontinental helicopter flights, were the first helicopters to fly advanced aerobatic maneuvers, and set numerous world records.

This outstanding designer and tireless worker did not have an easy life. But although he lived far from his homeland for a great many years, he remained a patriot. Yes, he was grateful to America, the country which gave him the opportunity to engage in his life's work. But he constantly emphasized that he was a "Russian-American." He always closely followed events in Russia. During World War II he took part in the campaign of aid to the Soviet Union.

Today, as we are in the process of reassessing and reanalyzing our history and filling in vast "blank spots," great fellow countrymen of whom we are justly proud are returning to us, as it were. The career and accomplishments of Igor Ivanovich Sikorsky attest to the fact that he was a great aircraft designer of the 20th century, and his name is justly inscribed in gold letters in the history of Russian and world aviation.

Western Military Aviation Development Briefs

90R10008L Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 89 (signed to press 6 Oct 89) pp 38-39

[Unattributed article: "Foreign Aviation Briefs"; based on materials published in the foreign press]

[Text] **F-15E Fighter-Bomber**

The U.S. Air Force has decided to replace the obsolete F-111 with the F-15E fighter-bomber, which is capable of performing the air superiority role as well as the deep interdiction mission. The new aircraft, while externally almost fully identical to its prototype, differs from it in many respects. First and foremost the airframe has been significantly altered and strengthened. Airframe life has been doubled over the basic F-15, now running 16,000 hours. With an aircraft logging up to 500 hours each year, the Air Force will be able to keep each F-15E in service more than 30 years.

The engine bays have been redesigned. They have been modified for installation of the Pratt & Whitney F100 PW-220 and General Electric F110 GE-100 afterburning turbofan engines, as well as future upgrades of these engines. A digital electronic engine control system provides capability to advance from idle to maximum thrust augmentation in four seconds—40 percent faster than the previously-used hydraulic-and-mechanical-linkage system.

A contract has been let for the manufacture of F-15E engine monitoring displays. These displays will combine the functions of numerous gauges indicating separate parameters and will provide a reduction in weight and space requirements for monitoring gauges. The display will incorporate solid-state electronic components and a single integrated liquid-crystal display.

Additional measures have been taken to increase aircraft survivability: use of self-sealing fuel tanks and lines, and filling of tanks and adjacent airframe spaces with foam material. Low-altitude flight safety is provided by high-strength improved polycarbonate windscreen glass. Accommodating a weapons system operator station and additional avionics has resulted in reducing the size of one of the fuel tanks. At the same time it is planned to mount conformal tanks along the engine air intake trunks, plus up to three underwing drop tanks. This will provide maximum fuel capacity of 9,820 liters.

F-15E fighter-bombers will be equipped with a totally new triplex digital fly-by-wire control system developed by Lear-Siegler. This system makes it possible to improve aircraft performance characteristics at all altitudes, but it is designed primarily to provide capability to fly in terrain-following mode at a height of 60 meters. Experts believe that the triplex system will ensure the requisite degree of reliability during low-level flight even if one channel fails. Following flight tests on the F-15E, which took place in the latter half of 1987, it was

announced that it will also be possible to fly in terrain-following mode at a height of 30 meters.

The battlefield air interdiction mission required development of a new system of targeting, navigation, and cockpit display avionics. This is why a weapons officer has been added.

The F-15E features a Hughes APG-70 radar, which is a considerably-improved version of the Hughes AG-63 radar carried by earlier models of the F-15. It can operate in synthetic-aperture mode, which provides high-resolution surface mapping capability and can detect such targets as airfields and bridges at a distance of about 130 km. The software being developed for the radar incorporates a new air-to-air mode for long-range air threat search—high-frequency pulse repetition and range strobing. Since a radar operating in continuous mode gives the aircraft away, the system is provided with a single-scan mode, with the image "frozen" on the display. The radar does not emit signals in the most dangerous, terminal phase of the attack on a ground target.

The F-15E's avionics package is to include an integral tactical information distribution system terminal, which provides a multicolor display of air situation data in any direction relative to the aircraft, to a distance of up to 64 km. This information includes data on the location and direction of movement of "friendly," "threat" and unidentified aircraft, on speed and altitude of a pilot-selected aircraft, as well as possibly information on aircraft type as well. In addition, the unit can display information on the airborne radar's coverage area, pre-selected air corridors, national borders, as well as location and effective air defense engagement zones of friendly and enemy forces.

The F-15E fighter-bomber will be the first NATO aircraft to be equipped with the regular-production LANTIRN low-altitude targeting system. It consists of two externally-mounted pods—a navigation and a targeting pod, mounted under the starboard and port engine air intake trunks respectively. Externally-mounted armament is carried on a pylon under each wing and on one belly pylon. An M61A1 20 mm Vulcan six-barrel aircraft cannon, with 940 rounds of ammunition, is mounted on the rear portion of the starboard wing. Air-to-air weapons include AIM-9 Sidewinder short-range and AIM-7 Sparrow or AIM-120 AMRAAM missiles. Air-to-ground weapons include six Hughes ACM-65 Maverick missiles, guided and free-fall bombs, including B-57 or B-61 nuclear bombs.

Flight testing of the F-15E is to run three years. The U.S. Air Force plans to buy at least 115 of these aircraft to replace the existing McDonnell-Douglas F-4C Wild Weasel radar suppression aircraft. It is projected that the contract can be let by March 1990.

Following are the principal specifications and performance figures on the F-15E fighter bomber: wingspan—13.05 m; length overall—19.43 m; height overall—5.63 m; wing area—56.5 square meters. Single-engine static thrust at sea level, with/without afterburning—10,637/6,520 kg. Aircraft empty weight equipped—14,380 kg. Maximum combat payload—10,650 kg. Maximum takeoff weight—36,740 kg. Maximum speed at ground level—1,480 km/h. Service ceiling—18,300 m. Ferry range—in excess of 5,550 km. Endurance with maximum fuel load—more than five hours.

BERP Rotor Blade

British engineers have developed new helicopter main rotor blades, made of composite materials and with widened, arrow-shaped blade tip, designated type BERP (British Experimental Rotor Program). An HB Westland G-Lynx helicopter equipped with such blades set a world level-flight speed record of 400.87 km/h on 11 August 1987. Advancing blade tip airflow velocity was close to the speed of sound (Mach 0.97). According to a statement by company spokesmen, the speed record set two years ago was not for publicity but demonstrated successful employment of a blade capable of withstanding flight at a airflow velocity close to the speed of sound and with retreating blade stall delay. The designers expect improved speed performance characteristics on future light combat and antitank helicopters using BERP rotor blades.

Using Composite Materials on Helicopters

Among factors affecting advances in helicopter engineering, today special importance is attached to the development and application of new materials, and composite materials in particular. Using materials other than metal in the helicopter airframe structure reduces helicopter empty weight and improves performance characteristics, including speed, with lower operating and maintenance costs. On military helicopters these new materials would be used to meet requirements of minimal radar signature and reduced vulnerability.

Assembly of the 360 experimental helicopter, which incorporates several aerodynamic improvements, was completed in April 1987. The fuselage of this tandem-design helicopter is entirely of composite materials (the formers are of carbon fiber, and the fuselage panels are of Nomex filler and Kevlar skin), while main rotor blades, hubs, and power shafts employ fiberglass. This made it possible to reduce helicopter empty weight by 15 percent. Takeoff weight is 13,800 kg. Typically the airframe contains 83 percent fewer parts, and the total number of fasteners is reduced by 93 percent.

The Sikorsky Corporation is working on designing a helicopter main rotor hub of composite materials. Engineers propose to fabricate it entirely of epoxy glass-fiber and reinforced-carbon plastic. According to their calculations, diagonal positioning and weaving of the fibers will prevent material from peeling off. Weight savings resulting from using nonmetallic materials will total approximately 41 kg.

The company is working on development of lighter-weight materials in order to expand the capabilities of helicopter utilization. For example, the proposed use of intermetallic compounds such as aluminide of iron or chromium, which are projected to come into use in about 10 years, will make it possible to fabricate items with walls six times thinner than at the present time. It is difficult at present to figure the economic benefits from employment of these new materials, since they are five or six times as expensive as conventional materials.

Airplane in "Wrapping"

West German Engineers have wind-tunnel tested surfaces coated with a synthetic film containing grooves 0.05 millimeter in depth and width. It has been determined that they generate much lower drag, as much as 8 percent lower. Although such a synthetic coating would weigh as much as 150 kilograms for a large aircraft, researchers have concluded that this is half as heavy as paint. And calculations indicate that fuel savings with an aircraft in "wrapping" will amount to 50 tons annually.

Unit Propaganda Officer Suggests Better Interethnic Friendship Indoctrination

90R10008M Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 89 (signed to press 6 Oct 89) p 40

[Article, published under the heading "New Approaches to Internationalist Indoctrination," by Maj M. Agronskiy: "Let's Not Lose the Objective Behind the Form"]

[Text] **Internationalism has been and continues to be a most important element of our ideology, the ideological credo of Communists.**

From the proceedings of the September (1989) CPSU Central Committee Plenum

* * *

I follow with interest the articles carried in this magazine dealing with problems of interethnic relations and internationalist indoctrination of military personnel. I would imagine that the extensive discussion of this subject at the September (1989) CPSU Central Committee Plenum and at the USSR Congress of People's Deputies, as well as the exchange of opinions and experience in the press are useful to commanders, political workers, party and Komsomol activists, who today are making use of every opportunity to diversify and introduce something new into the system of internationalist indoctrination.

At the same time it seems to me that many authors become a bit carried away with procedural forms and methods. I am not against inquiry and initiative, but I am against revival of the cult of form. Otherwise we shall once again return to a situation where all kinds of union republic days, months, and 10-day periods as well as other measures will be conducted for purposes of getting it on the report record rather than to benefit the men. In addition, every unit propaganda officer knows that preparing for agitation-propaganda and mass cultural events which are substantial in concept and composition takes up so much time and effort that one can easily forget about other areas of organizational and political indoctrination work. And yet tasks pertaining to indoctrination of proper interethnic relations and internationalist sentiments require an integrated approach and solution to a greater extent than any others.

We in the political section analyzed the ethnic makeup of the units and separately of the body of agitation-propagandist activists. Quite frankly, our conclusions provide a good deal of food for thought.

Among compulsory-service personnel, for example, there are many representatives of the peoples of the Central Asian and Transcaucasian republics. At the same time there was not one representative of these peoples out of 60 political instruction group leaders. They are also poorly represented among officers and warrant officers. It seems to me that with this ratio of ethnic composition between indoctrinators and indoctrinees, one cannot really speak seriously about such concepts as ethnic-psychological compatibility and consideration of ethnic awareness and culture and ethnographic traits, even with a high level of officer general educational and political training.

Of course when political instruction groups are formed we shall take this deficiency into account and correct it to the extent that this is possible. But the problem remains. In my opinion this magazine should draw the attention of Air Force command authorities and political directorate, personnel agencies, military commissariats, and other appropriate organizations to this problem. We need commanders, pilots, engineers, and technicians of various nationalities and ethnic affiliation in our units, individuals who by virtue of their example in performance of duty and active participation in indoctrination work establish a genuinely internationalist spirit in their unit.

I feel that it is also high time to move from words to deeds in resolving the problem caused by the fact that a significant portion of conscripts inducted from the Central Asian republics have a poor knowledge of Russian. Let us be frank: that "literacy campaign" currently in progress in some Air Force units and subunits at the initiative of party and Komsomol activists, as well as political instruction group leaders, barely provides a "subsistence minimum" of knowledge of the Russian language on the part of junior aircraft maintenance specialists. It is not surprising that the function of the primary-rank enlisted personnel and sergeant mechanic is becoming increasingly more insignificant in the squadrons and aircraft maintenance units.

In my opinion the solution lies in coordinated efforts on the part of military commissariats, local public education agencies, DOSAAF clubs and schools, and military-patriotic associations. Young men should at least be able

to learn conversational Russian in the course of those several years between registering at the military commissariat and induction into the military. And this can be done if military commissariat officials will bear administrative and party responsibility for the quality of preparation of future inductees.

Questions connected with enhancing the role played by sociological research in military units and taking the obtained data into consideration in the practical activities of commanders, political workers, party and Komsomol organizations are being raised with increasing frequency and urgency in the military press. I feel that it is also high time to devise appropriate methods in the area of research on problems of internationalization of life in the military and, most important, in arming with these methods those persons who are directly involved in educating and indoctrinating personnel.

We frequently complain that enlisted personnel do very little reading. I discussed this with many young Air Force personnel of various ethnic affiliation. They told me that not everybody is able to read and understand a book in Russian. There are either no books at all in their native languages to be found in the unit libraries, or what books are to be found are boring reading. I have a suggestion in this regard: Voyenizdat should begin publishing a library series of the best works of literature in the languages of the peoples of the union republics.

And since we have brought up the topic of the interrelationship between culture and ethnic relations and the influence of literature and art on the process of internationalist indoctrination, it would seem necessary to evaluate and revise from the standpoint of current requirements the procedural approaches taken by our cultural and educational establishments and military performing groups.

I recall my tour of duty with the limited Soviet forces in Afghanistan. Performances by the Soviet Army Red-Banner Song and Dance Company imeni A. Aleksandrov and companies from the Transcaucasus, Odessa, Baltic, Turkestan, and other military districts evoked in Air Force personnel a strong surge of patriotic, internationalist feelings! You should have seen the faces of the officers, warrant officers, and enlisted personnel when the music and songs of their homeland rang forth from the improvised stages and performance areas and when ethnic folk dances were performed. It was prestigious to fly to Afghanistan on a performance tour, which you cannot say about our Air Force bases at home, particularly those in remote areas.

I believe that patronship visits to units and bases by Komsomol agitation brigades from the union republics as well as a better-planned system of organization of guest appearances by professional and amateur performing groups could more effectively promote the cause of international indoctrination.

Some readers might comment: Is this propaganda officer kidding? But I am not proposing anything out of the ordinary or unachievable. In addition, much of what I have said falls within or, in my opinion, should fall within the duties of officials involved with indoctrination of military personnel or with supporting the educational process. And if we want to see our subordinates and colleagues as genuine patriots and internationalists, each of us must work properly in our own assigned area of responsibility to accomplish this.

Practical Benefits of Space Medical Research

90R10008N Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 89 (signed to press 6 Oct 89) p 41

[Article, published under the heading "The Space Program Serving Science and the Economy," by Doctor of Medical Sciences N. Gurovskiy, USSR State Prize recipient: "In the Interests of Health Care"]

[Text] Today there is perhaps no field of human activity on which the stimulating influence of the space program is not felt. It has enriched not only our knowledge of space and earth but of health care as well. As manned space flight has developed, methods of monitoring the cosmonauts' state of health have improved and more knowledge has been gained about man's capabilities and the processes of his preparation for demanding ordeals in space. Space medicine is today benefiting health protection both in space and on earth.

Here are some specific examples of the interlinkage between space medicine and terrestrial medicine.

As we know, in the process of its development, space medicine had to solve problems pertaining to selecting and training cosmonauts for orbital missions, formulation of requirements pertaining to living environment in conditions of weightlessness and life-support systems, and evaluation of the system's reactions to the effect of factors of space flight. The specialist personnel who initiated work in this area encountered a lack of knowledge on a number of items, in particular what the proper reactions of a healthy person should be in various conditions or the optimal content of harmful pollutants in the atmosphere aboard a spacecraft. In connection with this, special studies were performed in order to deepen our knowledge on the boundaries of the normal and on pathology. Clinicians dealing with patient therapy have begun utilizing their results.

The methods used in pilot screening and selection were refined in the course of examining cosmonauts, and new methods were devised, which made it possible to determine latent pathology. Today they have been adopted as clinical practices, such as in investigating the vestibular analysor and determining latent coronary insufficiency.

As we know, weightlessness causes loss of muscular fitness and changes in cardiovascular activity, in the bone system, and in mineral exchange. In connection with this it was necessary to conduct research aimed at studying the effect of diminished motor activity on the system. Bed regimen is presently considered a model of weightlessness in laboratory conditions.

One might ask what this research has to do with practical health care. The fact is that it has a direct relation to health care. Hypokinesia is very important as an etiological factor in the occurrence of a number of diseases, particularly of the cardiovascular system.

Examination of healthy individuals has revealed a number of symptoms characteristic of a state of hypokinesia. It is essential for clinicians to know these symptoms, for they must be able to differentiate between what phenomena are occurring in the patient due to the principal affection and what ones are occurring solely due to restriction of mobility.

The idea of continuous remote monitoring which is applied in space medicine has found practical application in clinics, in the field of health resort medicine, and in medical monitoring of athletes. Special equipment has also been developed, based on principles laid down in space medicine. Similar systems are used in postoperative care and in the emergency rooms of many medical establishments. The Telekont biotelemetry system, designed to monitor the condition of heart-attack patients, is undergoing testing.

It would make sense to use satellite communications links for hospitals located in regions far from the country's leading medical centers. Today there is no great difficulty involved in performing such "remote diagnosis." A prototype of such a system was certified during the operations of the 28th Soviet Antarctic Expedition. Using portable medical instruments, a doctor took an expedition member's EKG and blood pressure right in a field tent. This data was conveyed in the form of a digital radio transmission via satellite to Moscow, where the data was interpreted and analyzed; the medical conclusions were transmitted back via satellite to the doctor in Antarctica.

The principles of "remote diagnosis" form the basis of operation of a mobile automated laboratory ("Avtosan") for mass medical examination of the public. This laboratory contains practically the same medical equipment as the Salyut space station.

Examination of a patient takes about 15 minutes. Approximately 50 items are measured and computed. Two portable computers perform data analysis, automatic patient questionnaire, and processing of all data. All data on each person examined can be entered into a data bank and used later during annual medical checkups.

Unfortunately at the present time we are far from being able to encompass the entire population with such "space methods."

The Oksimetr device was developed to investigate cosmonaut oxygen supply, a device which is now being used in some clinics for diagnosis of a number of diseases: in a dental clinic in cases of parodontitis, in a surgical clinic in connection with plastic surgery, and in a therapy clinic in cases of ischemic heart disease.

Specialists in space medicine have devised methods of examining intestinal microflora, which are used in clinical practice in studying the state of intestinal microflora on patients with chronic affections of the gastrointestinal tract.

Detoxication of extended-storage donor blood involves passing it—following incubation (1-1.5 hours prior to the procedure) with adenine and inosine—through a sorbent column (type SKN-100). This procedure makes it possible to store this blood up to 52 days. Normally donor blood, preserved with a glucose-citron preserving agent, is kept for 10-15 days. This is a considerable difference. The Committee on Discoveries and Inventions stated that this method is of great economic significance. It provides savings of approximately 2,000 rubles in storing one liter of blood.

During space flight there is no natural alternation between day and night, and many of the system's functions are deprived of synchronizers, which can lead to dissynchronosis. The problem of the biological clock is of great significance. Study of biorhythms is pertinent in connection with east-west passenger flights and existence in the economy of numerous jobs involving production shifts. Biorhythm research conducted in the field of space biology and medicine has made a substantial contribution in this problem area as well.

In conclusion we should mention one additional item. In cosmonaut screening and selection psychological examination helps reveal latent and atypical forms of disorders, helps predict an individual's behavioral and emotional reactions in conditions of stress, helps determine a number of mechanisms of interaction of individuals in the process of group activity, and helps validate principles of group screening and selection. This makes it possible correctly to assemble a group of individuals for joint activity, in particular in making up athletic teams, in forming parties for expeditions to the North Pole and for mountain-climbing expeditions.

Thus this new field of knowledge, in addition to performing specialized tasks, stimulates and promotes development of general biology and practical health care, enriching them with new methods and ideas.

Soviet Shuttle Pilots Train On Dynamic Simulator

90R10008O Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 89 (signed to press 6 Oct 89) pp 44-45

[Article, published under the heading "Space Flight Support," by A. Moroz, training team leader: "Automatic-Mode Flight"]

[Text] The Buran shuttle accomplished an automatic-mode landing on 15 November 1988.

Thousands of persons took part in design and development of this craft. In this article we shall be talking about the flight crews and their training, because it is they who, drawing on their own skill, technical knowledge, and staying power, "taught" the craft to fly.

Initially there were six of them: Igor Petrovich Volk, Rimantas Stankyavichyus, Anatoliy Semenovich Levchenko, Aleksandr Vladimirovich Shchukin, Ivan Ivanovich Bachurin, and Aleksey Sergeyevich Boroday. All of them are test pilots, who have flown dozens of different types of aircraft and who possess vast experience in flight testing.

The complexity of the design and construction of the Buran and a new approach to testing it required totally different training of flight crews. While from 100 to 150 flights are scheduled for "taming" the conventional aircraft, for example, only 16 flights were designated for the Buran. There was a good reason for this number. The entire primary series of tests on the craft and its systems was performed on the ground in wind tunnels, on simulating units and test benches, as well as aboard airborne laboratories. All that remained was to test out the obtained results in actual flight conditions. At this point a Buran analogue craft was built. It was taken airborne not by an Energiya launch vehicle but by four added air-breathing jet engines. Each test flight was fully packed with procedures, and the aircrew's activities were scheduled down to the second. This was why thorough training and preparation of the pilots was so important, and why it was so important that they rehearse test flights down to the last detail, both involving normal flight conditions and with possible occurrence of malfunctions and other abnormal situations. Their program schedule for this period consisted of three sections: technical, simulator, and actual flight.

The crews were given a series of lectures, discussions were held on aerodynamics, flight dynamics, procedures of plotting flight paths, onboard systems operation, and information support. The pilots themselves, displaying active interest in the process of undergoing technical training, made many suggestions and comments to the developers. Some of them were incorporated into the design of the Buran.

Crew simulator training was done primarily on a dynamic flight simulator, which consisted of the following: flight deck mock-up; Buran analogue motion simulation system; external visual environment simulation system; coupled computers; instructor consoles.

The interior of the flight deck mock-up—seats, controls, instruments, control panels, illumination—was identical to the actual Buran flight deck.

A special sound system reproduced engine noise in the cockpit.

The motion simulation system, using hydraulic cylinders, displaced the flight deck mock-up and reproduced all changes in motion imparted to the analogue by the pilot with the control yoke or by the automatic landing system by means of control signals.

The external visual environment simulation system reproduced on monitors placed outside the cockpit windows the landing strip and a view of the surrounding terrain, that is, everything the pilots saw at a given moment during the analogue's "flight."

During this time a computer, solving shuttle craft motion equations, modeled its flight, control system, control signal forming system, and fed signals to all flight deck instruments. All this made it possible to create the illusion of actual flight in the flight deck mock-up.

The instructor consoles were used to introduce initial conditions for each practice session, simulated malfunctions and emergencies. Instructors would simultaneously monitor crew performance. Crew simulator training commenced long before the first flight of the Buran analogue, and for this reason the dynamic flight simulator instructor staff were unsure about a number of questions. The first of these was the question of how the craft's aerodynamic and flight performance characteristics, obtained by calculation and experiment and fed into the flight simulator computer, compared with the analogue's actual performance characteristics, because if discrepancies are substantial, then in training flight personnel one could train false habits in flying the Buran.

The second problem was the fact that they would be training the test pilots to fly on a new type of experimental spacecraft. Before putting their faith in the automatic system, first it was necessary to make several manual landings with the analogue and acquaint flight personnel with its landing approach flight path and its flight dynamics, so that later the pilots could properly monitor the automatic system and immediately respond to any deviations from normal. The Buran, an aerospace plane possessing a relatively poor aerodynamic efficiency and traveling at a speed in excess of 500 km/h on its landing approach glide, descends with a vertical component of up to 100 m/s. Under these conditions the pilots must determine within a fraction of a second whether the craft is entering proper alignment with a runway which is about 70 meters wide, whether it will touch down at the proper point and within the allowable envelope of landing speeds. If deviations are detected, the pilot must immediately take over control and, after

correcting the error, land the analogue manually or else, adding throttle, abort the landing and go around.

The third question involved malfunctions and emergency situations. The dynamic flight simulator made it possible to practice the most varied crew actions, for which an appropriate list of various malfunctions and errors was drawn up and carried out on the flight deck simulator. These items totaled approximately 150.

In conformity with this method, individual flight elements were thoroughly practiced and rehearsed with the crews, as well as a standard flight path for the analogue's first actual flight, after which all this was repeated again and again, but this time with sequential addition of the entire list of malfunctions and abnormal situations. All crew actions were continuously monitored by the methods specialist-instructors from the instrument readings at their consoles. A final performance evaluation would be based on the results of a post-flight analysis of the data recorder materials. This laborious task was subsequently greatly simplified by using an automated system for evaluating crew performance both in normal flight conditions and when dialing in malfunctions and abnormal situations. The computer would evaluate pilot performance and immediately after a simulator session would print out basic results in the form of compact, graphic tables.

And now a brief word about crew flight training. This training was done under the auspices of the Flight Testing Institute and encompassed general and specialized training. The crews took part in testing new aircraft and worked on the Buran's systems and principles of shuttle craft control, aboard flying laboratories specially designed for this purpose.

Finally the day arrived for the maiden flight of the Buran analogue. The first crew was to go up—test pilots I. Volk and R. Stankyavichyus. The analogue, its engines roaring, rolled down the runway, took off, flew around the pattern, made a landing approach and, smoothly touching down on the concrete runway, came to a stop following a short landing roll. All nervousness was now behind them. The flight had ended successfully. After landing, the crew "went up" one more time, but this time on the arms of their comrades.

Analysis of the telemetry obtained from the first flight confirmed the similarity between the dynamic characteristics of the flight simulator and the Buran analogue. Now it was possible successfully to complete preparing the aircrews for all subsequent flights and to issue the appropriate readiness documents. We should note that the elite team of test pilots and Buran cosmonauts logged more than 3,200 hours of simulator training.

The developed method of training flight crews made it possible fully to complete the program of perfecting the automatic landing procedure. And the tests performed on 15 November 1988 were the best proof of this. This gives reason to believe that this method can be employed in the future both in training crews of similar craft as well as military and civil aviation aircrews.

Articles Not Translated From AVIATSIYA I KOSMONAVTIKA No 11, November 1989

00000000 Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 89 (signed to press 6 Oct 89) p 48

Publication Data

90R10008R Moscow AVIATSIYA I KOSMONAVTIKA in Russian No 11, Nov 89 (signed to press 6 Oct 89)

[Text] English title: AVIATION AND COSMONAUTICS

Russian title: AVIATSIYA I KOSMONAVTIKA

Editor: O. A. Nazarov

Publishing house: Voyenizdat

Place of publication: Moscow

Date of publication: November 1989

Signed to press: 6 October 1989

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85

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